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Table of Contents

PREFACE

Настоящее учебное пособие включает актуальные тексты учебно-познавательной тематики для магистрантов специальности «Прикладная математика и информатика».

Целью данного пособия является формирование навыка чтения и перевода научно-популярных и собственно научных текстов, а также развитие устной научной речи обучающихся.

Пособие состоит из 5 разделов, рассматривающих проблемы и достижения в сфере информационных технологий в современном мире. Каждый из них содержит аутентичные материалы (источники: *Aeon, BBC Future, Nautilus, The Guardian*) и упражнения к ним.

Пособие может успешно использоваться как для аудиторных занятий, так и для внеаудиторной практики.

1. Group smarts

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: collective, infrastructure, individuals, addressing, to maximize, positive, interest, method, enthusiast, rating

Exercise II.

Make sure you know the following words and word combinations.
scholarly papers, to care for, juries and judges, court cases, self-evident, to hone in, to shape a team, shortcomings, to take an interest, to elicit, insight, to downpay, disdain, expertise, to mitigare, to discourage, naysayer, case study, full-fledged, pitfall, to foster, payoff

Group smarts

How do the most successful groups elicit collective intelligence from their members?

As the proverb goes, it takes a village – not just to raise a child, but to keep the village alive. We need planners and engineers to work together to maintain the infrastructure of the village, parents and teachers to jointly care for our children, and juries and judges to decide our court cases. Working together is an unavoidable part of modern life and, as we develop more tools to communicate with others across the world, tasks once delegated to individuals are now the work of teams. Take science, for instance; in the past several decades, there's been a huge shift towards teamwork. Whereas academics used to publish scholarly papers on their own, that work is now dominated by teams. It seems self-evident that a group of experts could produce more insights than a single scientist, but a team faces a different set of challenges than an individual. Only in recent years we have begun to hone in on how to shape a smart *team*, not just a collection of smart individuals. A strong team can work faster and better than a single smart individual – but not all teams are strong. Managing a smart individual is hard work, but managing an effective team requires extra attention. In addition to addressing individual needs, a team must work *together* – a goal best accomplished in an environment that maximises each individual's positive contributions while downplaying his shortcomings. Over the past decade, study after study has attempted to decipher the qualities of the 'smart group'. Just as psychologists have tried to uncover the 'g' factor responsible for an individual's general intelligence, they're digging into the 'c' factor – the secret sauce of collective intelligence. And most importantly, we want to know how to bring that 'c' factor to all our collaborative work, whether that's in the the classroom, the lab, backstage or even in space. (1)

Humans have been working together long before we took an interest in finding out how to perfect our methods. We've always hunted together, made fire together, built villages together. There is power in numbers – not only safety, but also aggregate wisdom. We tend to disdain averageness – we like to think of ourselves as above average, even if it's impossible for all of us to be – but averageness can represent the best of humans. When you average a bunch of our guesses, the collective us is more intelligent. Scientists have leveraged the power of the crowd in science projects such as NASA's Clickworkers, where science enthusiasts looked at photos of the Moon to identify crater features. The average person's contributions were as good as experts' – and they managed to provide far more ratings than any group of experts could manage. The project was so successful that NASA has started a new site using the same technique, where students along with the interested public help map Mars by looking at photos taken by satellites and rovers, and tagging features such as craters, land and sky. Large groups of trained amateurs can produce even better outcomes than experts. Through the Good Judgment Project, led by a team of decision-makers and economic experts, thousands of volunteer forecasters were asked to predict national security issues and world events, such as the probability of terrorist attacks or clashes between nations. These volunteers had no particular expertise, but collective predictions outperformed security experts' by about 30 per cent. (2)

In some cases, collective intelligence emerges from no order whatsoever. In non-human creatures such as fish, bees, ants and even bacteria, individuals form 'swarms' to coordinate complicated behaviours such as group size and where to forage and build homes. Through swarming, humans have created things such as Wikipedia, which has no central leadership but produces reasonably accurate encyclopaedia entries and human language might be the result of swarming. Now there are several new projects seeking to harness humans' collective intelligence through swarms. One is Unanimous AI, or UNU, a platform that uses crowd opinions to predict future events. UNU is organised into themed rooms where any user can ask any question he likes. Questions appear on the screen above a hexagon; each point of the hexagon represents a possible answer. In the middle of the hexagon is a puck that represents the people's will; if the hexagon were the walls of a cell, the puck would be its nucleus. Each person in the group controls a digital magnet she can use to drag the puck towards the answer of her choice. UNU uses an algorithm to manage chatters' responses. For instance, the closer a user places her digital magnet to the puck, the more 'pull' she exhibits. Essentially, this manner of voting allows UNU to aggregate collective behaviour as though we were an animal swarm, but with built-in integrity to guard against the usual threats to integrity in a human group. The model provides anonymity. And the real-time aspect of the system helps to overcome human biases, such as voting for what everyone else is choosing. It could be just a coincidence, but there's evidence that the swarm is pretty good at its predictions – perhaps even better than just the average crowd's. In 2015, scientists recreated Galton's original ox-weighing experiment by polling more than 17,000 people, whose average guess came pretty close. UNU, on the other hand, recruited a swarm of only 49 people, but their average guess was also pretty close. UNU's founder Louis Rosenberg has observed that letting people swarm leads to more effective answers; if you take those same 49 people and ask them to guess individually, their average guess is markedly worse. (3)

Even if swarming or other 'wisdom of the crowd' measures provide excellent results, the logistics of this type of crowdsourcing doesn’t lend itself very well to the problems that real teams face. It would be impossible to crowdsource a complex project such as conducting an experimental drug trial or sending a human to the Moon, projects that require big-picture visions but also the divvying up and completion of smaller tasks. In these cases, specialised teams need to discuss and collaborate to meet specific goals. So how do we build a smart team? Collaboration is the hard part, and this is where teams can fall apart. Individuals come to a team with a whole host of cognitive biases, and while one’s intuition might be that a diversity of perspectives could mitigate those biases, collaboration can actually amplify biases such as our tendencies to overestimate how much control we have over events and how much we can generalise from a small sample of data. Group work also discourages us from making mistakes. While this might sound like an overall good thing, consider that failure is an important part of learning. Acknowledging failure is the hard part of this learning process. But in a group, admitting failure can be a hit to your ego and reputation – an obvious disincentive to owning and learning from your mistakes. In teamwork, we can fall prey to our basest of human desires – being loved, respected, and seen as competent – and avoid owning up to our mistakes. Plus, when mistakes are made in a team, it’s more difficult to identify the origin of failure as members becomeb complacent in their belief that their teammates have made the right decisions. Imagine a nurse who discovers that a patient has been on an IV drip containing the wrong medicine for hours after their surgery. The team of experts caring for this patient is vast. It’s difficult to pinpoint where the process went wrong, and how it could be remedied. Did another nurse get two IV bags mixed up? Or was it the pharmacy that mistakenly sent the wrong medicine? What about the other specialists who saw this patient but didn't inspect carefully enough to catch the error – are they responsible too? A key factor in these types of mistake is complacency, a hallmark of group behaviour. To preserve unity, each individual member avoids being 'the difficult one' who rocks the boat; doubts go unvoiced. Insularity can exacerbate the problem; a team might descend further into its own cocoon, writing off any indications that its decisions or plans won't work, and distancing itself from potential naysayers by viewing outsiders as dumb or even malicious. Complacency in a team's expertise turns into overconfidence. (4)

The psychologist Irving Janis was the first to study this phenomenon. Using historical examples of political and military disasters such as Japan's attack on Pearl Harbor as case studies, Janis posits that the real danger of groups is not authoritarian rule, but the type of quiet complacency that morphs into overconfidence. Not all groups fall prey to groupthink. But if a group does, it can be hard to see from the inside. For instance, Janis's research indicates that though the US military had been warned about the potential for an attack at Pearl Harbor, they were overly confident in their safety. They rationalised this complacency by telling themselves that the Japanese would never attack, since it would inspire a full-fledged war. So how do we avoid these pitfalls? To combat groupthink, it helps for teams to get out of their usual rhythm. One way to do this would be to break up into smaller groups that can produce a more diverse set of ideas, providing more perspectives for the team at large. Inviting outside experts to share their views at meetings can also shake up the team dynamic, and prevent members from becoming too complacent about their own ideas. Having an avenue for people to voice minority or dissenting views, or cultivating a work culture where people feel safe giving their honest opinion, can add much-needed alternative perspectives to the discussion. (5)

Aside from combatting groupthink, there are other design features that can increase a team's likelihood of success. One is to examine the size of the team. Based on research at 15 large, multi-national companies such as Nokia and the BBC, teams of more than 20 have trouble coordinating; there are just too many people to manage and keep track of. Large, diverse teams of specialised experts are less likely to share knowledge and resources with one another, and are less likely to support one another's workload – for instance, shifting around roles to accommodate individual needs. Who is in the group is also key. An effective group is not just a matter of picking strong individuals. Rather, it's a blend of individual strengths, weaknesses, biases, work styles and preferences, which interact differently. While power can boost performance in tasks when an individual is working alone, nothing destroys team dynamics faster than a leader with an ego. When people are tasked with leading a group, that power can go to his head. The powerful are often less polite, less empathetic, and more concerned with maintaining their own reputation and authority than with the success of the team. So it follows that you certainly don't want a *team* of hotshots. While it might sound like a good idea to call on the best of the best, doing so can lead to team strife. Egos will be tested and that can distract from the task at hand. It turns out that there's a delicate balance of big egos and subordinates necessary for a productive group. Performance peaks when roughly half the team members are all-stars. Any more than that tips the balance, and performance drops. This even holds true when you create pretend all-stars. When researchers randomly assigned one person in a group to have power over subordinates, they found that even a little bit of imaginary authority went to people's heads; judges who rated groups on their mock business plans observed that the fake powerful become more concerned with their status within the group, and less focused on the task. This behaviour affected the rest of their group, too; groups with these appointed all-stars became less likely to reach agreement. To avoid this power clash, teams can try to define roles and tasks before beginning a project; this prevents team members from devoting their energies to jockeying for position. But most importantly, team members must be committed to leaving their big egos at the door. What follows is what good leaders already know: create an environment where people feel that their contributions are valued, and that group will work better together. Researchers have found that groups in which all members talk about the same amount, do well. No one benefits when the boss dominates the discussion; team members want to feel heard, and they will be more motivated to share ideas and offer honest feedback when they feel like their contributions are valued. Part of working well together stems from knowing your teammates well enough to read their subtle cues: Rob rubs his eyes when he's bored; Kim misses a beat in response when she's thinking of a polite way to say it's a bad idea. This also means learning how to read teammates well enough that you can productively resolve conflicts. (6)

Given how social skills play into a group's 'c' factor, perhaps it's not surprising that researchers have also found that groups with women tend to outperform male-heavy groups. Politeness and empathy are among the many social skills women are expected to master, like how to direct criticism with sensitivity, and how to diffuse office politics with smiles and small-talk. An office's worth of subtle, rarely acknowledged emotional labour typically falls to women. (7)

High-functioning teams also keep lines of communication open, and create times and spaces to foster personal relationships. Of course, there's no proven formula for building relationships. One avenue is brutal, unflinching honesty, as in the case of a Google manager who jumped into intimacy with his team by telling them he had stage-4 cancer. From that point on, his team shared personal details with one another, which opened them up to more honesty about what was and wasn't working for them in the office – and led them to be one of the most productive teams at Google. Another option for building team rapport is humour – good-natured humour, that is. Jokes in poor taste can make team members feel alienated. But in a best-case scenario, humour helps teams stay interested in their work, which can improve morale, especially as more employees expect work to be fun. Humour also makes team members feel closer to one another, even in work hierarchies, and can foster the trust and honesty that helps teams get things done. During tense disagreements or debates, a well-placed joke can lighten the mood and get a team back in sync with one another. (8)

Avoiding groupthink, eliminating ego-driven behaviour, and fostering trust and openness can give teams a better shot at being successful, but implementing all these ideas is a real challenge. And it's worth noting that each study illuminating evidence for what makes a 'good team' is just a snapshot of how a specific group of people performed in a specific task in a specific situation. Real life is largely out of our control. Still, like teamwork itself, the potential payoffs of cracking the 'c' factor are huge – and we'll keep striving together until we do. (9)

Adapted from Aeon.

Exercise III.

Find paragraphs, dealing with the following: infrastructure, self-evident , hone, downplaying, enthusiasts, rovers, amateurs, decision-makers, terrorist attacks, non-human creatures

Exercise IV.

Fill in the gaps according to the text.

1. Working together is an unavoidable part of modern life and, as we develop more tools to communicate with others across the world, tasks once delegated to individuals are now the work of……...
2. Take science, for instance; in the past several decades, there's been a huge shift towards…………
3. Whereas academics used to publish ………… on their own, that work is now dominated by teams.
4. Over the past decade, study after study has attempted to decipher the qualities of the…………. .

5. Scientists .... the power of the crowd in science projects such as NASA's Clickworkers, where science enthusiasts looked at photos of the Moon to identify crater features.

6. The project was so successful that NASA has started a new site using the same technique, where students along with .... help map Mars by looking at photos taken by satellites and rovers, and tagging features such as craters, land and sky.

7. Through the the Good Judgment, led by a team of decision-makers and economic experts, thousands of .... were asked to predict national security issues and world events, such as the probability of terrorist attacks or clashes between nations.

8. These volunteers had no particular expertise, but collective predictions .... security experts' by about 30 per cent.

9. Through swarming, humans have created things such as…………, which has no central leadership but produces reasonably accurate encyclopaedia entries and human language might be the result of swarming.

10. In 2015, scientists recreated Galton's original ox-weighing experiment by polling more than 17,000 people, whose .... came pretty close.

Exercise V .

Make up sentences of your own with the following word combinations: to care for, court cases, self-evident, to hone in, to shape a team, to require extra attention, individual needs, downplay, shortcomings, to take an interest in.

Exercise VI.

Determine whether the statements are true or false. Correct the false statements:

1. Working together is an unavoidable part of modern life and, as we develop more tools to communicate with others across the world, tasks once delegated to individuals are now the work of teams.
2. Take science, for instance; in the past several decades, there's been a huge shift towards teamwork.
3. Whereas academics used to publish scholarly papers on their own, that work is now dominated by teams.
4. It seems self-evident that a single scientist could produce more insights than a group of experts.
5. Only in recent years we have begun to hone in on how to shape a smart *team*, not just a collection of smart individuals.
6. A a single smart individual can work faster and better than strong team.
7. All teams are strong.
8. Managing an effective team is hard work, but managing a smart individual requires extra attention.
9. Humans have been working together long before we took an interest in finding out how to perfect our methods.
10. There is power in numbers – not only safety, but also aggregate wisdom.

Exercise VII .

Match the words to the definitions in the column on the right:

downplay	to make something perfect or completely suitable for its purpose
expert	clear or obvious without needing any proof or explanation
shortcoming	the basic systems and services, such as transport and power supplies, that a country or organization uses in order to work effectively
hone	a number of people or animals who do something together as a group
self-evident	a group of people who have been chosen to listen to all the factsin a trial in a law court and to decide if a person is guilty or not guilty, or if a claim has been proved
judge	a place where trials and other legal cases happen, or the people present in such a place, especially the officials and those deciding if someone is guilty
team	a person with a high level of knowledge or skill relating to aparticular subject or activity
infrastructure	a person who is in charge of a trial in a court and decides how aperson who is guilty of a crime should be punished, or who makes

	decisions on legal matters
jury	a fault or a failure to reach a particular standard
court	to make something seem less important or less bad than it really is

Exercise VIII.

Summarize the article "Group smarts."

Part 2

Exercise I.

Identify the part of speech the words belong to: infrastructure, self-evident, to produce, scientist, attention, addition, environment, to maximise, positive, contributions

Exercise II .

Form verbs from the following words:
planners (1), collective (2), contributions (2), forecasters (2), collective (2), predictions (2), user (3), founder (3), communication (8), openness (9)

Exercise III.

Find synonyms to the following words. Translate them into Russian: maintain (1), to decide (1), start (2), self-evident (1), hone (1), to shape (1), smart (1), shortcoming (1), successful (2).

Exercise IV.

Find antonyms to the following words. Translate them into Russian:
to maintain (1), self-evident (1), single (1), shortcoming (1), successful (1), new (2), public (2).

Exercise V.

Match the words to make word combinations:

non-human	expertise
particular	intelligence
science	cases
trained	experts
court	attention
collective	features
crater	projects
individual	amateurs
security'	creatures
extra	needs

Exercise VI .

QUIZ (SQL)

SQL or Structured Query Lanaguage is the most popular language used to create, retrieve, update and delete data from relational databases.

1) Which SQL command would you use to retrieve a record or records from the database?

A. FIND

B. SELECT

C. SEARCH

D. RETRIEVE

2) Which SQL command would you use to add a new record (row) to the database?

A. ADDROW

B. UPDATE

C. NEWRECORD

D. INSERT

3) Which SQL command would you use to modify the contents of an existing record (row) in the database?

A. MODIFY

B. INSERT

C. UPDATE

D. MERGE

4) What does the command: 'TRUNCATE TABLE Sample' do?

A. Reindexes the rows in the table called Sample.

B. Deletes the table called Sample.

C. Empties all data (rows) from the table called Sample.

D. There is no command called Truncate.

5) Look at the following SQL statement:

INSERT INTO ________________

VALUES (value1, value2)

What belongs in the blank?

A. the column(s) name

B. none of the above

C. the database name

D. the table name

6) The ALTER tablename command would be used to...

A. create a new table in the database

B. none of the above

C. rename the database table

D. add columns to or drop columns from an existing database table

7) This aggregate SQL function will return the number of rows in a database table.

A. COUNT(column_name) or COUNT(*)

B. MAX(column_name)

C. SUM(column_name)

D. NUM(column_name)

8) This is a column with a unique value for each row used to bind data together, across tables, without repeating all of the data in every table.

A. None of the above

B. Primary Column

C. Primary Key

D. Index

9) This type of JOIN statement will return all the rows from the first table, even if there are no matches in the second table.

A. LEFT JOIN

B. INNER JOIN

C. RIGHT JOIN

D. OUTER JOIN

10) A WHERE clause can be added to a SELECT statement to add conditions to the rows being returned.
SELECT * FROM products WHERE ordernumber >= 1000
What rows will this select statement return?

A. All rows in the products table whose order number is greater than or equal to 1000.

B. All rows in the products table whose order number is less than or equal to 1000.

C. The first 1000 rows of the product table.

D. All rows in the products table whose order number is greater than 1000.

2. Cover of darkness: will online anonymity win the war of openness vs privacy

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: anonymous, intellectual, secret, service, monitoring, operation, telecommunications, details, code.

Exercise II.

Make sure you know the following words and word combinations.
to keep something free of, state interference, to pass legislation, in essence, to stay hidden online, to overreach, snooper, distributed, to contribute, end run, honourable, to evade, scope, whistleblower, to pit, to inhibit, malicious, enforcement, rule of thumb.

Cover of darkness: will online anonymity win the war of openness vs privacy

What will happen when everyone is anonymous?

Let's see if this rings any bells. Back in the early 1990s, just as networked computing was taking off and millions of people logged on for the first time, the US government started getting worried. Although still tiny, 'cyberspace' was a nuisance to the law. Anonymous hackers were stealing intellectual property. Internet trolling was rife. And so the

US Secret Service upped its monitoring of the online world. In May 1990, it launched Operation Sundevil, a nationwide crackdown on hackers. Meanwhile, law-makers tried to pass legislation to force telecommunications companies to hand over their customers' details and prevent the spread of powerful cryptography software. In essence, the US government was trying to limit the ability of citizens to stay hidden online. But a few citizens had other ideas. A small band of Californian libertarians began developing tools to keep the net free of state interference. They set up an email list that ultimately ended up predicting, inventing or refining nearly every technique now employed by computer users to avoid government surveillance. It was around this time that a tool called PGP (for 'Pretty Good Privacy') first emerged. It was created singlehandedly by a US programmer named Phil Zimmerman, who felt alarmed at what seemed to him like a disproportionate push by the law into citizens' private space. He decided to make the code of his PGP software freely available to all. Today, it remains the industry standard for text- and file-based encryption on the net. When it comes to matters of privacy, every government reaction has a citizen counter-reaction. This one was known as the 'crypto-wars'. By 2001 an anonymous browser allowing users to use the web without anyone being able to track them was in development, untraceable black markets had sprung up online. (1)

Back in the 1990s, the internet was very obscure: the preserve of hobbyists, academics and specialists. To most of us, the question of internet anonymity was irrelevant. But as more and more of us got online during the 2000s and started sharing (sometimes unwittingly, sometimes not) more about ourselves, the question of digital rights and freedoms started to go mainstream. Surveys and polls started to find that internet privacy was quickly becoming a big deal to the man on the street. Today, in response to another perceived overreach of governments into our digital space, we appear to be entering a second crypto-war. Ever since the US computer professional Edward Snowden blew his whistle on the US National Security Agency in 2013 and we got our glimpse of the extent of various state surveillance programmes, there has been a boom in the use of (usually free) software to keep internet users anonymous. The anonymous browser 'Tor'– which allows people to use the net without giving away their internet protocol (IP) address – has leapt in popularity. And more people are using the 'dark net', an encrypted network of sites that uses the Tor protocol to make tracking close to impossible. Perhaps more importantly, there are hundreds of people working on ingenious ways to block censorship and keep secrets online: projects that are designed for the mass market rather than the computer specialist. So, there will soon be a new generation of easy-to-use auto-encryption email services, such as 'Dark Mail'. And we can expect to see more distributed social networks: services that function without the kind of centralised server that is vulnerable to state snoopers. Take 'Twister', a sort of censorship-free version of Twitter. Every user of the platform runs his own copy of the public record of everything that's been posted, all hosted on his own computer. Everything could be done anonymously, and with this sort of distributed system, censorship would be close to impossible. No one can shut it down because no one owns it. This seems as good a time as any to ask what we want from the internet. How should it balance openness and privacy? What about law and anarchy? And as events unfold, is there anything we can do to decide the outcome? (2)

Twister is part of a trend toward a decentralisation of the net. Another is called ‘MaidSafe’, which is a UK start-up that aims to redesign the internet infrastructure towards a peer-to-peer communications network, without centralised servers. Its developers are building a network made up of contributing computers, with each one giving up a bit of its unused hard drive. You access the network, and the network accesses the computers. It’s all encrypted and bits of data are stored all across the network, which makes hacking or spying far harder. When you open a browser and surf the web, it might feel like a seamless process, but there are all manner of rules and processes that clutter up the system: domain name servers, company servers, routing protocols, security protocols and so on. As Lambert explains, that centralisation results in powerful groups – whether governments, big tech companies, or invisible US-based regulators – exercising control over what happens on the net. That’s bad for security, and bad for privacy. Why do people keep trying to make an end-run around state supervision? Their motivations are typically honourable: they want to make sure that people can remain private online, to keep communication open and free of interference from third parties. The difference between now and the early 1990s is that this impulse is no longer confined to computer geeks. Ordinary people care about internet anonymity and are starting to use tools to get it. Facebook recently launched a version of its network on Tor – proof indeed that it’s becoming mainstream. The means of staying hidden online will only get easier to use, more widespread and ever more sophisticated. And these people have physics on their side: it is easier to encrypt something than to decrypt it. (Encrypting is like cracking an egg; decrypting it without the key is like trying to put it back together again.) It's not an exaggeration to say that the laws of mathematics tend toward secrecy. Although it might feel unlikely at a time when every click and swipe is being collected by someone somewhere, the direction of travel is toward greater online anonymity. In the years ahead, for those who want it, it will be easier to hide online. For better or worse, then, it seems that we should expect a good deal of anonymity on the internet of the future. And there is a lot to celebrate in that. In a world in which every bit of our online behaviour is collected, analysed and sold – a world in which governments have free access even to apparently private areas of the civilian internet – activists want to ensure liberty through maths and physics embedded in technology; in this way, they believe that they can chip away at the foundations of state power. Anonymity of all kinds serves a vital social and individual function. Freedom-fighters really do create secret and untraceable chat rooms to co-ordinate activity. Russian dissidents really do need to circumnavigate state censorship of the net. Gay people in the Middle East really do use anonymous browsers to evade the brutal enforcers of state morality. Then there are the whistleblower sites. The New Yorker, for example, has a 'Strongbox' site on the dark net for whistleblowers to share stories and leaks safely. Anonymity increases the scope for holding the powerful to account, and if nothing else, the internet has given states an awful lot more power. It isn't only in the more hostile parts of the world that this matters. In most democratic societies, privacy is seen as a vital part of the sphere of the individual, a precondition for all other kinds of political expression. Well-established democracies use secret ballots to ensure that people can register their political views without fear of reprisal. Anonymity contributes to free expression. (3)

Anonymity is written into the very fabric of the net for this very reason. The pioneers of internet architecture were largely academics who wanted to encourage other programmers to work anonymously to improve the design and structure of the network. They were inspired by the model of the blind peer-review journal: the academic way to ensure that ideas are judged on quality not provenance, so that the best ones rise to the surface. Besides, it can be difficult to explore sensitive or personal subjects when everyone can see who you are. Having a place where you can speak honestly and openly without fear of judgment is extremely important – and the net is where you go to do it. Anonymity also results in more interesting content. Sites that have barely any moderation are typically more creative than those that are tightly managed by administrators. Take the infamous image-sharing board 4chan, where most people post under the username ‘Anonymous’. 4chan generates an astonishing amount of inventive, funny and offensive material. The site prides itself on the anonymity it offers users – pitting itself directly against networking sites such as Facebook and Google+, both of which require users to sign in with their legal names (though of course, many people don’t). Lawless zones such as 4chan might be offensive or nasty – but they can also toughen us up. After all, it’s usually by coming into contact with controversial or extreme ideas that we sharpen our own senses, and develop our own moral compass. (4)

None of which is to deny that anonymity has its problems, or that they might become more serious if the net as a whole were to start operating under the cover of darkness. Studies repeatedly find that people behave worse when they believe they won't be held accountable for their actions. Cyber psychologists think that we are more likely to be more nasty, and more disinhibited, when protected by the screen. One researcher, the psychologist John Suler of Rider University in New Jersey, writing in the mid-1990s, called this the 'online disinhibition effect'. He'd been studying early online communities and found that people tend to act more aggressively toward strangers when communicating via a computer. According to a recent survey by the polling company YouGov, 28 per cent of adults in the US admitted to 'malicious online activity directed at somebody they didn't know'. Unfettered anonymity can also undermine free expression, since it prevents others from taking part in debate and expressing their own views. Twitter has become a hostile place for many – especially female – writers and commentators who are bombarded with threats from anonymous Twitter users each time they raise their head above the parapet. For non-celebrities, it's often just as bad, though much less discussed. Many people have left the platform as a result. That can be distressing and hurtful, of course. But far more seriously, the truth is that along with the journalists, human rights activists and dissidents, groups such as Islamic State and serious criminals will be early adopters of anything that can help them stay hidden. Take the Tor network: it started life as a US military-funded research project, then became an open-source charity aimed at ensuring that civil rights activists and journalists can browse the net safely around the world. It is vital for free expression. And yet, according to researchers, 44 per cent of Tor Hidden Services (websites that use the same protocols to also stay hidden) are given up to criminality – mainly anonymous ‘dark net markets’ that sell almost anything to anyone. Anders Breivik, the Norwegian terrorist who murdered 77 people in Oslo in 2011 urged others to use the Tor browser in his ‘Manifesto’. Islamic State Twitter accounts share information about how to use Tor. On dark net markets, almost every possible drug is available. Some venues sell guns, bomb-making instructions – which could create a significant opportunity for terrorist groups. It’s also well-established that some hackers use encryption and anonymous browsers to stay one step ahead of the law, making it more or less impossible to rid the net of images of crime and abuse. (5)

These horror stories aren’t sufficient to justify blanket legal restrictions on the use of anonymous technology, of course. Terrorists also use telephones, cars and cash. Nor is it the fault or responsibility of the people that design and create those tools – it’s down to individuals to take responsibility for how they use these tools. But some technology tilts the balance of power toward those breaking the law – and it is, after all, the state’s primary responsibility to provide public safety and security. For all the benefits of online anonymity, it is not an absolute right. There should not be parts of the internet that are entirely beyond the reach of the law enforcement, any more than we should accept similar zones of anarchy offline. At present, though, there is surprisingly little clarity to be found in law about the right to internet privacy. To make matters even murkier, quite what ‘privacy’ means is not entirely clear any more, since notions of privacy changed when we all went online. There are no obligations on us to declare who we are each time we communicate in a public place, or buy a magazine in a shop. I can wear gloves and a balaclava on the street if I choose. But under certain circumstances, vital for the purposes of law enforcement, I will be compelled to remove them. Under stop-and-search powers, the police can compel you to reveal yourself. To vote, to attend school, to travel overseas – in almost every part of life there are requirements to reveal who we really are. So it should be online. We all should have the right to be anonymous online if we wish, just as we can offline. We should be free to use Tor, to use fake accounts, anonymising operating systems, encryption, and so on. But democratically elected governments should have the capability and legal right to break that anonymity if it is necessary and if there is a good legal system and regulation to ensure that these powers are not misused. As anonymising software becomes more popular, as I'm quite convinced that it will, a new approach for law enforcement will be necessary. That will require greater investment in digital policing: new people, new skills, new capabilities. That has to cover how public agencies can access our private information online, what the limits are to online anonymity, and under what circumstances it can be legally broken. When assessing big-picture trends such as these, it's not always helpful to think in terms of one mass aggregate score. Nevertheless, I think that the overall influence of online anonymity will remain a positive one for individual and social liberty. Anonymity is often valuable and important at different times and in different places, which is reason enough to defend it. Because once it's gone, it's usually gone for good. As a general rule of thumb, once governments have powers to monitor citizens, they rarely surrender them. Perhaps anonymity in the future will be even more important than it is now. Oscar Wilde once wrote that if you give a man a mask, he'll tell you the truth. True, but he's more likely to be mean and nasty while he's at it. We just have to live with that. (6)

Adapted from Aeon.

Exercise III.

Find paragraphs, dealing with the following:

surveillance, interference, surveillance, disproportionate, untraceable, obscure, hobbyist, academics, specialist, anonymity

Exercise IV.

Fill in the gaps according to the text.

1. Back in the early 1990s, just as networked computing was taking off and millions of people............... for the first time, the US government started getting worried.
2. Although still tiny, …………. was a nuisance to the law.
3. Anonymous ………….. were stealing intellectual property.
4. Internet ……….. was rife.
5. And so the US Secret Service …........ its monitoring of the online world.
6. In April 1990, it launched Operation Sundevil, a nationwide …............. on hackers.
7. In essence, the US government was trying to limit the ability of citizens…...................... online.
8. A small band of ………… began developing tools to keep the net free of state interference.

9. It was around this time that a tool called PGP (for '................') first emerged.
10. It was created singlehandedly by a US programmer named Phil Zimmerman, who …..................... at what seemed to him like a disproportionate push by the law into citizens' private space.

Exercise V .

Make up sentences of your own with the following word combinations: to log on, to stay hidden, to keep something free of, state interference, to pass legislation, in essence, to stay hidden online, to be free of

Exercise VI.

Determine whether the statements are true or false. Correct the false statements:

1. Back in the early 1990s, just as networked computing was taking off and millions of people logged on for the first time, the US government started getting worried.
2. Although still tiny, 'cyberspace' was a nuisance to the law.
3. Anonymous hackers were stealing intellectual property.
4. Internet trolling was not rife.
5. And so the US Secret Service upped its monitoring of the online world.
6. In April 1990, it launched Operation Sundevil, a nationwide crackdown on hackers.
7. Meanwhile, law-makers tried to pass legislation to force telecommunications companies to hand over their customers' details and prevent the spread of powerful cryptography software.
8. In essence, the UK government was trying to limit the ability of citizens to stay hidden online.
9. A small band of Californian libertarians began developing tools to keep the net free of state interference.

10. It was created singlehandedly by a German programmer named Phil Zimmerman, who felt alarmed at what seemed to him like a disproportionate push by the law into citizens' private space.

Exercise VII .

Match the words to the definitions in the column on the right:

anonymous	not known to many people
disproportionate	the careful watching of a person or place, especially by the police orarmy, because of a crime that has happened or is expected
log on	a computer program that makes it possible for you to read information on the internet
obscure	the subjects that you study in high school or college
track	someone who hacks into other people's computer systems
web	made or done by someone whose name is not known or not madepublic**:**
browser	too large or too small in comparison to something else, or notdeserving its importance or influence
surveillance	to start using a computer system or program by giving a password (= a secret word by which the system recognizes an approved user)
hacker	the system of connected documents on the internet
academics	to follow a person or animal by looking for proof that they have been somewhere, or by

	using electronic equipment

Exercise VIII.

Summarize the article "Cover of darkness: will online anonymity win the war of openness vs privacy."

Part 2

Exercise I.

Identify the part of speech the words belong to.

interference, surveillance, disproportionate, available, anonymous, to browse, development, untraceable, obscure, academics

Exercise II .

Form adverbs from the following words:

anonymous (1), private (1), irrelevant (2), easier (3), individual (3), awful (3), legal (4), extreme (4), moral (4), serious (5)

Exercise III.

Find synonyms to the following words. Translate them into Russian: interference (1), disproportionate (1), available (1), anonymous (1), development (1), track (1), obscure (2), academics (2), specialist (2), surveillance (1),

Exercise IV.

Find antonyms to the following words. Translate them into Russian: disproportionate (1), available (1), anonymous (1), specialist (2), irrelevant (2), freedom (2), impossible (2), ingenious (2), open (2), invisible (2)

Exercise V.

Match the words to make word combinations:

internet	interference
dark	list
state	surveillance
email	Agency
research	net
Secret	property
Security	project
online	protocol
government	Service
intellectual	world

Exercise VI .

QUIZ (Google Earth is Spying On Me!)

Google Earth is a software program that allows you to view the earth in 3D but it also has many more functions. How much do you know about this extremely useful program?

1) The company that developed the original software upon which Google Earth is based, Keyhole, Inc., acquired some of its initial funding from which secretive US government agency?

A. NASA

B. State Dept.

C. DOD

D. CIA

2) What major world event in 2003 gave a huge boost to Google Earth's predecessor, EarthViewer, when major news broadcasters used its capabilities to cover the event with 3D flyby imagery?

A. Space Shuttle Columbia's last flight

B. Invasion of Iraq

C. Georgian Rose Revolution

D. Hurricane Isabel

3) The Google Sky feature of Google Earth allows viewers to explore the heavens. Of the four sources below, which one is NOT a source used by Google Sky?

A. Soyuz satellites

B. Sloan Digital Sky Survey

C. Hubble Telescope

D. NASA satellites

4) Google Earth has a feature that allows you to see a 360-degree panoramic view of many major metropolitan cities. What is this feature called?

A. Road View

B. Highway View

C. Avenue View

D. Street View

5) Google Earth has a feature that allows you a 3D view of which ancient city as it looked in 320 AD?

A. Jerusalem

B. Paris

C. Rome

D. London

6) Not only does Google Earth feature terrestrial locations, but it also features another planet from our solar system. Which planet is this?

A. Mercury

B. Mars

C. Saturn

D. Venus

7) Google Moon was made a part of Google Earth 5 on July 20, 2009 to commemorate the 40th anniversary of the first moon landing. Seven missions were sent to land on the moon but Google Moon only features six of them, why?

A. There were only six missions launched, not seven

B. One is still classified by NASA

C. One failed to actually land on the moon

D. The data from one was lost on reentry

3. What will it take to fix fake news?

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: president, result, special, alternative, fact, social, centre, politicians, expert

Exercise II

Make sure you know the following words and word combinations.

to plug the query into a search engine, top results, mainstream media, fake news, trusted sources, starting point, to cope with, to weed out, inaccurate information, regular feature, falsehhod, fuzzy, to bewilder, to peddle, controversy, to devastate, concern, to dismiss, to reinforce, WHO, political body, to stack up, self-awareness

What will it take to fix fake news?

With news sources splintering and falsehoods spreading widely online, can anything be done? Richard Gray takes an in-depth look at how we got here – and hears from the researchers and innovators seeking to save the truth.

Who was the first black president of America? It's a fairly simple question with a straightforward answer. Or so you would think. But plug the query into a search engine and the facts get a little fuzzy. When I checked Google, the first result – given special prominence in a box at the top of the page – informed me that the first black president was a man called John Hanson in 1781. Other search engines do little better. The top results on Yahoo pointed me to articles about Hanson as well. Welcome to the world of "alternative facts". It is a bewildering maze of claim and counterclaim, where hoaxes spread with frightening speed on social media and spark angry backlashes from people who take what they read at face value. Controversial, fringe views about US presidents can be thrown centre stage by the power of search engines. It is an environment where the mainstream media is accused of peddling "fake news". Voters are seemingly misled by the very politicians they elected and even scientific research - long considered a reliable basis for decisions - is dismissed as having little value. (1)

For a special series launching this week, BBC Future asked a panel of experts about the grand challenges we face in the 21st Century – and many named the breakdown of trusted sources of information as one of the most pressing problems today. In some ways, it's a challenge that trumps all others. Without a common starting point – a set of facts that people with otherwise different viewpoints can agree on – it will be hard to address any of the problems that the world now faces. The example at the start of this article may seem a minor controversy, but there is something greater at stake here. Leading researchers and tech companies say the threat posed by the spread of misinformation should not be underestimated. Some warn that "fake news" threatens the democratic process itself. "On page one of any political science textbook it will say that democracy relies on people being informed about the issues so they can have a debate and make a decision," says Stephan Lewandowsky, a cognitive scientist at the University of Bristol in the UK, who studies the persistence and spread of misinformation. "Having a large number of people in a society who are misinformed and have their own set of facts is absolutely devastating and extremely difficult to cope with." A survey conducted by the Research Center towards the end of last year found that 64% of American adults said made-up news strories were causing confusion about the basic facts of current issues and events. (2)

Working out who to trust and who not to believe has been a facet of human life since our ancestors began living in complex societies. Politics has always bred those who will mislead to get ahead. But the difference today is how we get our information. "The internet has made it possible for many voices to be heard that could not make it through the bottleneck that controlled what would be distributed before," says Paul Resnick, professor of information at the University of Michigan. "Initially, when they saw the prospect of this, many people were excited about this opening up to multiple voices. Now we are seeing some of those voices are saying things we don't like and there is great concern about how we control the dissemination of things that seem to be untrue." We need a new way to decide what is trustworthy. "I think it is going to be not figuring out what to believe but who to believe," says Resnick. "It is going to come down to the reputations of the sources of the information. They don't have to be the ones we had in the past." We're seeing that shift already. The UK's Daily Mail newspaper has been a trusted source of news for many people for decades. But last month editors of Wikipedia voted to stop using the Daily Mail as a source for information on the basis that it was "generally unreliable”. Yet Wikipedia itself - which can be edited by anyone but uses teams of volunteer editors to weed out inaccuracies - is far from perfect. Inaccurate information is a regular feature on the website and requires careful checking for anyone wanting to use it. Other than causing offense or embarrassment – and ultimately eroding a news organisation’s standing - errors do little long-term harm. There are some who care little for reputation, however. They are simply in it for the money. “The major new challenge in reporting news is the new shape of truth,” says Kevin Kelly, a co-founder of Wired magazine. “Truth is no longer dictated by authorities, but is networked by peers. For every fact there is a counterfact. All those counterfacts and facts look identical online, which is confusing to most people.” For those behind the made-up stories, the ability to share them widely on social media means a slice of the advertising revenue that comes from clicks as people follow the links to their webpages. The difference that social media has made is the scale and the ability to find others who share your world view. In the past it was harder for fringe opinions to get their views reinforced. If we were chatting around the kitchen table or in the pub, often there would be a debate. But such debates are happening less and less. Information spreads around the world in seconds, with the potential to reach billions of people. But it can also be dismissed with a flick of the finger. What we choose to engage with is self-reinforcing. It results in an exaggerated “echo chamber” effect. What is noticeable about the two recent referendums in the UK - Scottish independence and EU membership - is that people seem to be clubbing together with people they agreed with and all making one another angrier. The debate becomes more partisan, more angry and people are quicker to assume they are being lied to but less quick to assume people they agree with are lying. That is a dangerous tendency. The challenge here is how to burst these bubbles. One approach that has been tried is to challenge facts and claims when they appear on social media. Research suggests this approach may not be working, however. Scientists have been building software that can automatically track rumours on Twitter, dividing people into those that spread misinformation and those that correct it. “For the rumours we looked at, the number of followers of people who tweeted the rumour was much larger than the number of followers of those who corrected it,” they says. “The audiences were also largely disjointed. Even when a correction reached a lot of people and a rumour reached a lot of people, they were usually not the same people. The problem is, corrections do not spread very well.” One example of this that research team found was a mistake that appeared in a leaked draft of a World Health Organisation report that stated many people in Greece who had HIV had infected themselves in an attempt to get welfare benefits. The WHO put out a correction, but even so, the initial mistake reached far more people than the correction did. Only a tiny proportion were exposed to both the rumour and correction. This lack of overlap is a specific challenge when it comes to political issues. On Facebook political bodies can put something out, pay for advertising, put it in front of millions of people, yet it is hard for those not being targeted to know they have done that. They can target people based on how old they are, where they live, what skin colour they have, what gender they are. We shouldn’t think of social media as just peer-to-peer communication - it is also the most powerful advertising platform there has ever been. But we have never had a time when it has been so easy to advertise to millions of people and not have the other millions of us notice. Twitter and Facebook both insist they have strict rules on what can be advertised and particularly on political advertising. Regardless, the use of social media adverts in politics can have a major impact. We need to be more equipped to deal with this - we need watchdogs that will go around and say, 'Hang on, this doesn't stack up' and ask for the record to be corrected. Social media sites themselves are already taking steps. Mark Zuckerberg, founder of Facebook, recently spelled out his concerns about the spread of hoaxes and misinformation on social media in a letter he posted online. He said Facebook would work to reduce sensationalism in its news feed on its site by looking at whether people have read content before sharing it. It has also updated its advertising policies to reduce spam sites that profit off fake stories, and added tools to let users flag fake articles. Other tech giants also claim to be taking the problem seriously. Apple's Tim Cook recently concerns about fake news, and Google says it is working on ways to improve its algorithms so they take accuracy into account when displaying search results. "Judging which pages on the web best answer a query is a challenging problem and we don't always get it right," says Peter Barron, vice president of communications for Europe, Middle East and Asia at Google. "When non-authoritative information ranks too high in our search results, we develop scalable, automated approaches to fix the problems, rather than manually removing these one by one. We recently made improvements to our algorithm that will help surface more high quality, credible content on the web. We'll continue to change our algorithms over time in order to tackle these challenges." Google is also working with fact-checking organisations like Full Fact to develop new technologies that can identify and even correct false claims. Together they are creating an automated fact-checker that will monitor claims made on TV, in newspapers, in parliament or on the internet. Initially it will be targeting claims that have already been fact-checked by humans and send out corrections automatically in an attempt to shut down rumours before they get started. As artificial intelligence gets smarter, the system will also do some fact-checking of its own. For a claim like 'crime is rising', it is relatively easy for a computer to check. We know where to get the crime figures and we can write an algorithm that can make a judgement about whether crime is rising. The challenge is going to be writing tools that can check specific types of claims, but over time it will become more powerful. (3)

This idea of helping break through the isolated information bubbles that many of us now live in comes up again and again. By presenting people with accurate facts it should be possible to at least get a debate going. "There is a large proportion of the population in the US living in what we would regard as an alternative reality," says Lewandowsky. "They share things with each other that are completely false. Any attempt to break through these bubbles is fraught with difficulty as you are being dismissed as being part of a conspiracy simply for trying to correct what people believe. There is an unwillingness to bend one's mind around facts that don't agree with one's own viewpoint." Ultimately, however, there's an uncomfortable truth we all need to address. When people say they are worried about people being misled, what they are really worried about is other people being misled. Very rarely do they worry that fundamental things they believe themselves may be wrong. Technology may help to solve this grand challenge of our age, but it is time for a little more self-awareness too. (4)

Adapted from BBC Future.

Exercise III.

Find paragraphs, dealing with the following: hoaxes, starting point, to cope with, to weed out, falsehood, innovator, fuzzy, prominence, fact-checker, maze .

Exercise IV.

Fill in the gaps according to the text.

1. For a special series launching this week, BBC Future asked a panel of experts about …................... we face in the 21st Century – and many named the breakdown of trusted sources of information as one of the most pressing problems today.
2. Without a common……. – a set of facts that people with otherwise different viewpoints can agree on – it will be hard to address any of the problems that the world now faces.
3. Leading researchers and tech companies say the threat posed by the spread of misinformation should not be …....................
4. Some warn that ……..threatens the democratic process itself.
5. "On page one of any political science textbook it will say that democracy relies on people being informed about the issues so

they can have a debate and make a decision," says Stephan Lewandowsky, a cognitive scientist at the University of Bristol in the UK, who studies the persistence and ....

6. A survey conducted by the Research Center towards the end of last year found that 10% of American adults said ….................... were causing confusion about the basic facts of current issues and events.
7. "The internet has made it possible for many voices to be heard that could not …................................. that controlled what would be distributed before," says Paul Resnick, professor of information at the University of Michigan.
8. The UK's Daily Mail newspaper has been a …............... of news for many people for decades.
9. But last month editors of Wikipedia voted to stop using the Daily Mail as a source for information on the basis that it was "....................".
10. "The major new......................is the new shape of truth," says Kevin Kelly, a co-founder of Wired magazine.

Exercise V .

Make up sentences of your own with the following word combinations: to plug the query into a search engine (1), top results (1), mainstream media (1), fake news (1), trusted sources (2), starting point (2), to cope with (2), to weed out (3), inaccurate information (3), regular feature (3)

Exercise VI.

Determine whether the statements are true or false. Correct the false statements:

1. For a special series launching this week, BBC Future asked a panel of experts about the grand challenges we face in the 21st Century – and many named the breakdown of trusted sources of information as one of the most pressing problems today.
2. Leading researchers and tech companies say the threat posed by the spread of misinformation should not be underestimated.
3. "On page one of any political science textbook it will say that democracy relies on people being informed about the issues so they can have a debate and make a decision," says Stephan Lewandowsky, a cognitive scientist at the University of Bristol in the USA, who studies the persistence and spread of misinformation.
4. "Having a large number of people in a society who are misinformed and have their own set of facts is absolutely devastating and extremely difficult to cope with."
5. A survey conducted by the Research Center towards the end of last year found that 10% of American adults said made-up news stories were causing confusion about the basic facts of current issues and events.
6. "The internet has made it possible for many voices to be heard that could not make it through the bottleneck that controlled what would be distributed before," says Paul Resnick, professor of information at the University of London.

7. The USA's Daily Mail newspaper has been a trusted source of news for many people for decades.
8. But last year editors of Wikipedia voted to stop using the Daily Mail as a source for information on the basis that it was "generally unreliable".
9. Yet Wikipedia itself - which can be edited by anyone but uses teams of volunteer editors to weed out inaccuracies - is far from perfect.
10. Inaccurate information is a regular feature on the website and requires careful checking for anyone wanting to use it.

<u>Exercise VII</u> .

Match the words to the definitions in the column on the right:

maze	an unofficial interesting story or piece of news that might be trueor invented, and quickly spreads from person to person
spark	a person who develops a new design, product, etc. or who has newideas about how to do something**:**
prominence	a lie or a statement that is not correct
fuzzy	someone who starts an organization together with someone else
fake	the state of being easily seen or well known
innovator	an area in which you can get easily lost because there are so manysimilar streets or passages
counterclaim	not clear

co-founder	to cause the start of something, especially an argument orfighting
falsehood	an object that is made to look real or valuable in order to deceive people
rumour	a statement that someone makes in answer to a statement that has been made by someone else, and that is different from it

Exercise VIII.

Summarize the article "What will it take to fix fake news?"

Part 2

Exercise I.

Identify the part of speech the words belong to.

falsehood, innovator, fuzzy, co-founder, prominence, fact-checker, maze, counterclaim, rumour, controversial

Exercise II .

Form verbs from the following words: co-founder (2), misinformation(2), underestimated (2), organization (3), communication (3), improvements (3), fact-checker (3), corrections (3), judgement (3), information (4)

Exercise III.

Find synonyms to the following words. Translate them into Russian: fake (1), falsehood (1), innovator (1), fuzzy (1), prominence (1), bewildering (1), maze (1), spark (1), controversial (1), rumour (3)

Exercise IV .

Find antonyms to the following words. Translate them into Russian: falsehood (1), fuzzy (1), bewildering (1), spark (1), centre (1), reliable (1), agree (2), minor (2), underestimated (2), rumour (3)

Exercise V.

Match the words to make word combinations:

inaccurate	information
current	researchers
fake	media
search	sources
top	point
mainstream	companies
trusted	issues
starting	engine
leading	results
tech	news

Exercise VI .

QUIZ (The Python Programming Language)

Python, created by Guido van Rossum, is one of the most versatile programming languages today. It is widely used in web programming and known for its massive collection of user libraries.

1) Which of these is a Python control flow statement type?

A. elif

B. elsif

C. else if

D. case

2) Which of these structures does not exist in Python?

A. Dictionary

B. Array

C. List

D. Tuple

3) We start writing a program to compute the square of the first n numbers, where n is a number to be input by the user. But unfortunately, we do not have the ability to store the list in memory! Which of these functions would I use to bypass this constraint?

A. List comprehension

B. Hash table

C. Dictionary

D. Generator

4) How would I decorate a class method if I wanted to use it without initializing a class?

A. @property

B. @staticmethod

C. @use_outside

D. @global

5) Suppose we wanted to use a function A from library B, where A is a top-level function. Which of these is the correct way to import *only* A?

A. use A from B

B. from B import A

C. import B.A

D. use B.A

6) What does Python's 'set' data structure do?

A. Returns an ordered collection of unique elements

B. Returns an ordered collection of dictionary keys

C. Returns an unordered collection of dictionary keys

D. Returns an unordered collection of unique elements

7) Sometimes while performing file input/output, programmers forget to close the file, leading to errors and corrupted data. Which of the following can we do to prevent this?

A. Close the file manually

B. Back up all files

C. Write all the file data to a different file

D. Perform all file operations inside a 'with' block

8) When we run our code, we keep getting an error and our code stops running. Which one of these keyword pairs can we use to catch the error and bypass it to keep the code running?

A. try...except

B. do...catch

C. try...catch

D.do...except

9) Since lists are mutable, which of these methods would I use to add an element to the list?

A. +

B. add

C. append

D. concatenate

4. The hi-tech war on science fraud

Part 1

<u>Exercise I.</u>

Say what Russian words help to guess the meaning of the following words: multiculturalism, calculation, program, catalogued, statistical, result, virtually, massive, literature, method

<u>Exercise II</u>

Make sure you know the following words and word combinations.

scientific fraud, top priority, statistical miscalculations, in the neutral terms, scientific misconduct, to be aware, to venture into sensitive territory, mutual trust, to root out, rounding, to get rattled, exposed, to portend, peer review, to undermine, to condemn, unauthorised use, brainchild, inventory, to devise, handful, to ascend, commitment, bias, in the long run, to ramp up, workaround, to embrace the change, to endorse, to eradicate

The hi-tech war on science fraud

The problem of fake data may go far deeper than scientists admit. Now a team of researchers has a controversial plan to root out the perpetrators

One morning last summer, a German psychologist named Mathias Kauff woke up to find that he had been reprimanded by a robot.

In an email, a computer program named Statcheck informed him that a 2013 paper he had published on multiculturalism and prejudice appeared to contain a number of incorrect calculations – which the program had catalogued and then posted on the internet for anyone to see. The problems turned out to be minor – just a few rounding errors – but the experience left Kauff feeling rattled. "At first I was a bit frightened," he said. "I felt a bit exposed." Kauff wasn't alone. Statcheck had read some 50,000 published psychology papers and checked the maths behind every statistical result it encountered. In the space of 24 hours, virtually every academic active in the field in the past two decades had received an email from the program, informing them that their work had been reviewed. Nothing like this had ever been seen before: a massive, open, retroactive evaluation of scientific literature, conducted entirely by computer. Statcheck's method was relatively simple, more like the mathematical equivalent of a spellchecker than a thoughtful review, but some scientists saw it as a new form of scrutiny and suspicion, portending a future in which the objective authority of peer review would be undermined by uncredentialed critics. Susan Fiske, the former head of the Association for Psychological Science, wrote an op-ed accusing "self-appointed data police" of pioneering a new "form of harassment". The German Psychological Society issued a statement condemning the unauthorised use of Statcheck. The intensity of the reaction suggested that many were afraid that the program was not just attributing mere statistical errors, but some impropriety, to the scientists. (1)

The man behind all this controversy was a 25-year-old Dutch scientist named Chris Hartgerink, based at Tilburg University's Meta-

Research Center, which studies bias and error in science. Statcheck was the brainchild of Hartgerink's colleague Michèle Nuijten, who had used the program to conduct a 2015 study that demonstrated that about half of all papers in psychology journals contained a statistical error. Nuijten's study was written up in Nature as a valuable contribution to the growing literature acknowledging bias and error in science – but she had not published an inventory of the specific errors it had detected, or the authors who had committed them. The real flashpoint came months later, when Hartgerink modified Statcheck with some code of his own devising, which catalogued the individual errors and posted them online – sparking uproar across the scientific community. Hartgerink is one of only a handful of researchers in the world who work full-time on the problem of scientific fraud – and he is perfectly happy to upset his peers. "The scientific system as we know it is pretty screwed up," he told me last autumn. "I've known for years that I want to help improve it." Hartgerink approaches his work with a professorial seriousness and he is earnest about his aims. His conversations tend to rapidly ascend to great heights, as if they were balloons released from his hands – the simplest things soon become grand questions of ethics, or privacy, or the future of science. "Statcheck is a good example of what is now possible," he said. The top priority, for Hartgerink, is something much more grave than correcting simple statistical miscalculations. He is now proposing to deploy a similar program that will uncover fake or manipulated results – which he believes are far more prevalent than most scientists would like to admit. When it comes to fraud – or in the more neutral terms he prefers, "scientific misconduct" – Hartgerink is aware that he is venturing into sensitive territory. Despite its professed commitment to self-correction, science is a discipline that relies mainly on a culture of mutual trust. The exposure of fraud directly threatens the special claim science has on truth, which relies on the belief that its methods are purely rational and objective. For the past decade, the scientific community has been grappling with the discovery that many published results cannot be reproduced independently by other scientists – in spite of the traditional safeguards of publishing and peer-review – because the original studies were marred by some combination of unchecked bias and human error. Some methods are an inversion of the proper scientific method: the scientist starts by deciding what result he wants and then works backwards, filling out the individual “data” points he is supposed to be collecting.Yet scientists still have only the most crude estimates of how much fraud actually exists. But if none of the traditional authorities in science are going to address the problem, Hartgerink believes that there is another way. If a program similar to Statcheck can be trained to detect the traces of manipulated data, and then make those results public, the scientific community can decide for itself whether a given study should still be regarded as trustworthy. (2)

Hartgerink believes not only that most scientific fraud goes undetected, but that the true rate of misconduct is far higher than stated. “We cannot trust self reports,” Van Assen told me. Uri Simonsohn, a psychology professor at University of Pennsylvania’s Wharton School who gained notoriety as a “data vigilante” for exposing two serious cases of fraud in his field in 2012, believes that as much as 5% of all published research contains fraudulent data. “It’s not only in the journals people don’t read,” he told me. “There are probably several very famous papers that have fake data, and very famous people who have done it." But as long as it remains undiscovered, there is a tendency for scientists to dismiss fraud in favour of more widely documented issues. Even Arturo Casadevall, an American microbiologist who has published extensively on the rate, destribution, and detection of fraud in science, told me that despite his personal interest in the topic, my time would be better served investigating the broader issues. Fraud, he said, was "probably a relatively minor problem in terms of the overall level of science". In 1983, Peter Medawar, the British immunologist and Nobel laureate, wrote in the London Review of Books: "The number of dishonest scientists cannot, of course, be known, but even if they were common enough to justify scary talk of 'tips of icebergs', they have not been so numerous as to prevent science's having become the most successful enterprise (in terms of the fulfilment of declared ambitions) that human beings have ever engaged upon." From this perspective, as long as science continues doing what it does well – as long as genes are sequenced and chemicals classified and diseases reliably identified and treated – then fraud will remain a minor concern. But while this may be true in the long run, it may also be dangerously complacent. Furthermore, scientific misconduct can cause serious harm, as, for instance, in the case of patients treated by Paolo Macchiarini, a doctor at Karolinska Institute in Sweden who allegedly misrepresented the effectiveness of an experimental surgical procedure he had developed. Macchiarini is currently being investigated by a Swedish prosecutor after several of the patients who received the procedure later died. Even in the more mundane business of day-to-day research, scientists are constantly building on past work, relying on its solidity to underpin their own theories. If misconduct really is as widespread as Hartgerink and Van Assen think, then false results are strewn across scientific literature, like unexploded mines that threaten any new structure built over them. At the very least, if science is truly invested in its ideal of self-correction, it seems essential to know the extent of the problem. (3)

But there is little motivation within the scientific community to ramp up efforts to detect fraud. Part of this has to do with the way the field is organised. Science isn't a traditional hierarchy, but a loose confederation of research groups, institutions, and professional organisations. Universities are clearly central to the scientific enterprise, but they are not in the business of evaluating scientific results, and as long as fraud doesn't become public they have little incentive to go after it. There is also the questionable perception, although widespread in the scientific community, that there are already measures in place that preclude fraud. People routinely insist that science has a variety of self-correcting mechanisms, such as peer-review and replication. But the vast majority of cases of fraud were actually exposed by whistleblowers, and that holds true to this day. And so the enormous task of keeping science honest is left to individual scientists in the hope that they will police themselves, and each other. There is also the problem of relying on whistleblowers**,** who face the thankless and emotionally draining prospect of accusing their own colleagues of fraud. (4)

Scientists can commit fraud in a multitude of ways, but the majority of fraud cases in recent years have emerged from scientists either falsifying images – deliberately mislabelling scans and micrographs – or fabricating or altering their recorded data. What

Hartgerink and Van Assen needed was a way to analyse vast quantities of data in search of signs of manipulation or error, which could then be flagged for public inspection without necessarily accusing the individual scientists of deliberate misconduct. After all, putting a fence around a minefield has many of the same benefits as clearing it, with none of the tricky business of digging up the mines. To prove that their methods work, Hartgerink and Van Assen have to show they can reliably distinguish false from real data. But research misconduct is relatively uncharted territory. Only a handful of cases come to light each year – a dismally small sample size – so it's hard to get an idea of what constitutes "normal" fake data, what its features and particular quirks are. Hartgerink devised a workaround, challenging other academics to produce simple fake datasets, a sort of game to see if they could come up with data that looked real enough to fool the statistical tests, with an Amazon gift card as a prize. By 2015, the Meta-Research group had expanded to seven researchers, and Hartgerink was helping his colleagues with a separate error-detection project that would become Statcheck. He was pleased with the study that Michèle Nuitjen published that autumn, which used Statcheck to show that something like half of all published psychology papers appeared to contain calculation errors. (5)

When scientists publish papers in journals, they release only the data they wish to share. Critical evaluation of the results by other scientists – peer review – takes place in secret and the discussion is not released publicly. Once a paper is published, all comments and concerns must go through the editors of the journal before they reach the public and Hartgerink is part of an increasingly vocal group that believes that the closed nature of science, with authority resting in the hands of specific gatekeepers – journals, universities, and funders – is harmful, and that a more open approach would better serve the scientific method. Hartgerink realised that with a few adjustments to Statcheck, he could make public all the statistical errors it had exposed. He hoped that this would shift the conversation away from talk of broad results – such as the proportion of studies that contained errors – and towards a discussion of the individual papers and their mistakes. The critique would be complete, exhaustive, and in the public domain, where the authors could address it; everyone else could draw their own conclusions. In August 2016, with his colleagues' blessing, he posted the full set of Statcheck results publicly on the anonymous science message board PubPeer. At first there was praise on Twitter and science blogs, which skew young and progressive – and then, condemnations, largely from older scientists, who feared an intrusive new world of public blaming and shaming. Nature, a bellwether of mainstream scientific thought for more than a century, supported a future of automated scientific scrutiny in an editorial that addressed the Statcheck controversy without explicitly naming it. Its conclusion seemed to endorse Hartgerink's approach, that "criticism itself must be embraced". Yet change in science comes slowly, if at all, Van Assen reminded me. The current push for more open and accountable science, of which they are a part, has "only really existed since 2011", he said. It remains a small, fragile outpost of true believers within the vast scientific enterprise. When I asked Hartgerink what it would take to totally eradicate fraud from the scientific process, he suggested that scientists make all of their data public; register the intentions of their work *before* conducting experiments and that they have their results checked by algorithms during and after the publishing process. To any working scientist – currently enjoying nearly unprecedented privacy and freedom for a profession that is in large part publicly funded – Hartgerink's vision would be a draconian scientific surveillance state. Even scientists who have done similar work uncovering fraud have reservations about Van Assen and Hartgerink's approach. When Hartgerink and Van Assen say that they are simply identifying data that "cannot be trusted", they mean flagging papers and authors that fail their tests. And, as they learned with Statcheck, for many scientists, that will be indistinguishable from an accusation of deceit. When Hartgerink eventually deploys his fraud-detection program, it will flag up some very real instances of fraud, as well as many unintentional errors – and present all of the results in a messy pile for the scientific community to sort out. When I put this question to Van Assen, he told me it was certain that some scientists would be angered or offended by having their work and its possible errors exposed and discussed. He didn't want to make anyone feel bad, he said – but he didn't feel bad about it. Science should be about transparency, criticism, and truth. "The problem, also with scientists, is that people think they are important, they think they have a special purpose in life," he said. "Maybe you too. But that's a human bias. I think when you look at it objectively, individuals don't matter at all. We should only look at what is good for science and society." (6)

Adapted from The Guardian.

Exercise III.

Find paragraphs, dealing with the following: top priority, misconduct, venture, mutual, reprimanded, prejudice, minor, spellchecker, former head, harassment.

Exercise IV.

Fill in the gaps according to the text.

1. One morning last summer, a Dutch psychologist named Mathias Kauff woke up to find that he had been ……............ by a robot.
2. Statcheck had read some 50,000 published psychology papers and checked the maths ……....................... it encountered.
3. Statcheck's method was relatively simple, more like the mathematical equivalent of a spellchecker than a …...................., but some scientists saw it as a new form of scrutiny and suspicion, portending a future in which the objective authority of peer review would be undermined by uncredentialed critics.
4. Susan Fiske, the former head of the Association for Psychological Science, wrote an op-ed accusing "..................... data police" of pioneering a new "form of harassment".
5. The German Psychological Society........................... condemning the unauthorised use of Statcheck.
6. The man …............... was a 25-year-old Dutch scientist named Chris Hartgerink, based at Tilburg University's Meta-Research Center, which studies bias and error in science.
7. Statcheck was the ………. of Hartgerink's colleague Michèle Nuijten, who had used the program to conduct a 2015 study that demonstrated that about half of all papers in psychology journals contained a statistical error.

8. Nuijten's study was written up in Nature as a …....................... to the growing literature acknowledging bias and error in science – but she had not published an inventory of the specific errors it had detected, or the authors who had committed them.
9. The …...................... came months later, when Hartgerink modified Statcheck with some code of his own devising, which catalogued the individual errors and posted them online – sparking uproar across the scientific community.
10. Hartgerink is one of only a handful of researchers in the world who work full-time on the problem of …................... – and he is perfectly happy to upset his peers.

Exercise V .

Make up sentences of your own with the following word combinations:

scientific fraud, top priority, statistical miscalculations, to uncover fake, in the neutral terms, scientific misconduct, to be aware, to venture into sensitive territory, mutual trust

Exercise VI.

Determine whether the statements are true or false. Correct the false statements:

1. One morning last summer, a Dutch psychologist named Mathias Kauff woke up to find that he had been reprimanded by a robot.
2. Statcheck had read some 20,000 published psychology papers and checked the maths behind every statistical result it encountered.
3. Statcheck's method was not simple, more like the mathematical equivalent of a spellchecker than a thoughtful review, but some scientists saw it as a new form of scrutiny and suspicion, portending a future in which the objective authority of peer review would be undermined by uncredentialed critics.

4. The English Psychological Society issued a statement condemning the unauthorised use of Statcheck.
5. The man behind all this controversy was a 25-year-old German scientist named Chris Hartgerink, based at Tilburg University's Meta-Research Center, which studies bias and error in science.
6. Statcheck was the brainchild of Hartgerink's colleague Michèle Nuijten, who had used the program to conduct a 2015 study that demonstrated that about half of all papers in psychology journals contained a statistical error.
7. The real flashpoint came years later,when Hartgerink modified Statcheck with some code of his own devising, which catalogued the individual errors and posted them online – sparking uproar across the scientific community.
8. Hartgerink is one of only a handful of researchers in the world who work full-time on the problem of scientific fraud – and he is perfectly happy to upset his peers.
9. The top priority, for Hartgerink, is something much more grave than correcting simple statistical miscalculations.
10. Hartgerink believes not only that most scientific fraud goes undetected, but that the true rate of misconduct is far lower than stated.

Exercise VII .

Match the words to the definitions in the column on the right:

multiculturalis m	the careful and detailed examination of something in order to getinformation about it
fake	having little importance, influence, or effect, especially whencompared with other things of the same type

reprimand	having the same amount, value, purpose, qualities, etc.
calculation	a feeling or belief that someone has committed a crime or done something wrong
scrutiny	a computer program that makes certain that the words in a documenthave the correct letters in the correct order
prejudice	an object that is made to look real or valuable in order to deceive people
spellchecker	the belief that different cultures within a society should all be givenimportance
equivalent	an unfair and unreasonable opinion or feeling, especiall y whenformed without enough thought or knowledge
minor	to express to someone your strong official disapproval of them
suspicion	the process of using information you already have andadding, taking away, multiplying, or dividing numbers to judge thenumber or amount of something

Exercise VIII .

Summarize the article “The hi-tech war on science fraud.”

Part 2

Exercise I.

Identify the part of speech the words belong to:

multiculturalism, incorrect, calculations, massive, retroactive, evaluation, entirely, relatively, mathematical, equivalent

Exercise II .

Form verbs from the following words:

calculation (1), suspicion (1), evaluation (1), reaction (1), contribution (2), discovery (2), motivation (4), manipulation (5), detection (5), discussion (5)

Exercise III.

Find synonyms to the following words. Translate them into Russian: fake (1), similar (6), minor (1), simple (1), possible (6), scrutiny (1), suspicion (1), former (1), harassment (1), intensity (1).

Exercise IV.

Find antonyms to the following words. Translate them into Russian: incorrect (1), minor (1), similar (6), scrutiny (1), former (1), harassment (1), intensity (1), possible (6).

Exercise V.

Match the words to make word combinations:

former	program
mutual	data
personal	war
neutral	head
computer	interest
statistical	fraud
fake	trust
hi-tech	priority

scientific	terms
top	miscalculation

<u>Exercise VI .</u>

QUIZ (C++)

C++ is a programming language developed in Bell Laboratories. This quiz is on the basic elements of a C++ program. I hope you enjoy the quiz.

1) A double is classified as...

A. A floating point data type

B. An integer data type

C. A character data type

D. A Boolean data type

2) Which of the following is a legal C++ variable name?

A. exam4_grade

B. sales-tax

C. 25a

D. enum

3) What is the symbol for the modulus operator?

A. =

B. !

C. %

D. >

4) Which of the following is a string constant?

A. 'G'

B. "shirt"

C. 2073600

D. 18.02

5) What statement executes one set of statements when true and another when false?

A. The if statement

B. The switch statement

C. The if/else if statement

D. The if/else statement

6) What function is automatically called at the beginning of a C++ program?

A. srand()

B. getline()

C. main()

D. abs()

7) Which loop tests a condition after its iteration?

A. There is no such loop

B. The while loop

C. The do-while loop

D. The for loop

8) Assuming 78, 57, 65, 54, 89, 49 is an unsorted array, what will the array look like after the first pass when using the selection sort algorithm (you want to sort in ascending order)?

A. 49, 57, 65, 54, 89, 78

B. 78, 54, 57, 89, 65, 49

C. 57, 65, 54, 78, 49, 89

D. 78, 65, 89, 57, 54, 49

9) By default, how is the memory address of a pointer written when needing to put one in a program?

A. As a hexadecimal number

B. As an octal number

C. As a decimal number

D. As a binary number

5. Vanishing point: the rise of the invisible computer

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: decade, progress, chip, commercially, microprocessor, transistor, nanometer, electronic, fundamental

Exercise II

Make sure you know the following words and word combinations.

marvel of its time, revenue, exact number, integrated circuit, power-hungry, ultra-sophisticated equipment, order of magnitude, to convey, blistering, to cram, to amend, to give teeth to something, to shell out, compelling, frugal, sluggish, to wind down, bottleneck, counterintuitive, shielding, hub, feeble, comprehensible

Vanishing point: the rise of the invisible computer

For decades, computers have got smaller and more powerful, enabling huge scientific progress. But this can't go on for ever. What happens when they stop shrinking?

In 1971, Intel, then an obscure firm in what would only later come to be known as Silicon Valley, released a chip called the 4004. It was the world's first commercially available microprocessor, a marvel of its time, built from 2,300 tiny transistors, each around 10,000 nanometres (or billionths of a metre) across – about the size of a red blood cell. A transistor is an electronic switch that, by flipping between "on" and "off", provides a physical representation of the 1s and 0s that are the fundamental particles of information. In 2015 Intel, by then the world's leading chipmaker, with revenues of more than $55bn that year, released its Skylake chips. The firm no longer publishes exact numbers, but the best guess is that they have about 1.5bn–2 bn transistors apiece. Spaced 14 nanometres apart, each is so tiny as to be literally invisible, for they are more than an order of magnitude smaller than the wavelengths of light that humans use to see. Everyone knows that modern computers are better than old ones. But it is hard to convey just how much better, for no other consumer technology has improved at anything approaching a similar pace. The standard analogy is with cars: if the car from 1971 had improved at the same rate as computer chips, then by 2015 new models would have had top speeds of about 420 million miles per hour. That is roughly two-thirds the speed of light, or fast enough to drive round the world in less than a fifth of a second. If that is still too slow, then before the end of 2017 models that can go twice as fast again will begin arriving in showrooms. This blistering progress is a consequence of an observation first made in 1965 by one of Intel's founders, Gordon Moore. Moore noted that the number of components that could be crammed onto an integrated circuit was doubling every year. Later amended to every two years, "Moore's law" has become a self-fulfilling prophecy that sets the pace for the entire computing industry. Each year, firms such as Intel spend billions of dollars figuring out how to keep shrinking the components that go into computer chips. Along the way, Moore's law has helped to build a world in which chips are built in to everything from kettles to cars (which can, increasingly, drive themselves), where millions of people relax in virtual worlds, financial markets are played by algorithms and pundits worry that artificial intelligence will soon take all the jobs. (1)

But it is also a force that is nearly spent. Shrinking a chip's components gets harder each time you do it, and with modern transistors having features measured in mere dozens of atoms, engineers are simply running out of room. There have been roughly 22 ticks of Moore's law since the launch of the 4004 in 1971 through to mid-2016. For the law to hold until 2050 means there will have to be 17 more, in which case those engineers would have to figure out how to build computers from components smaller than an atom of hydrogen, the smallest element there is. That, as far as anyone knows, is impossible. Yet business will kill Moore's law before physics does, for the benefits of shrinking transistors are not what they used to be. Moore's law was given teeth by a related phenomenon called "Dennard scaling" (named for Robert Dennard, an IBM engineer who first formalised the idea in 1974), which states that shrinking a chip's components makes that chip faster, less power-hungry and cheaper to produce. Chips with smaller components, in other words, are better chips, which is why the computing industry has been able to persuade consumers to shell out for the latest models every few years. But the old magic is fading. Shrinking chips no longer makes them faster or more efficient in the way that it used to. At the same time, the rising cost of the ultra-sophisticated equipment needed to make the chips is eroding the financial gains. Moore's second law states that the cost of a “foundry”, as such factories are called, doubles every four years. A modern one leaves little change from $10bn. Even for Intel, that is a lot of money. The result is a consensus among Silicon Valley’s experts that Moore’s law is near its end. “From an economic standpoint, Moore’s law is dead,” says Linley Gwennap, who runs a Silicon Valley analysis firm. Dario Gil, IBM’s head of research and development, is similarly frank: “I would say categorically that the future of computing cannot just be Moore’s law any more.” Bob Colwell, a former chip designer at Intel, thinks the industry may be able to get down to chips whose components are just five nanometres apart by the early 2020s – “but you’ll struggle to persuade me that they’ll get much further than that”. One of the most powerful technological forces of the past 50 years, in other words, will soon have run its course. The assumption that computers will carry on getting better and cheaper at breakneck speed is baked into people’s ideas about the future. It underlies many technological forecasts, from self-driving cars to better artificial intelligence and ever more compelling consumer gadgetry. There are other ways of making computers better besides shrinking their components. The end of Moore’s law does not mean that the computer revolution will stall. But it does mean that the coming decades will look very different from the preceding ones, for none of the alternatives is as reliable, or as repeatable, as the great shrinkage of the past half-century. (2)

Moore’s law has made computers smaller, transforming them from room-filling behemoths to pocket-filling slabs. It has also made them more frugal: a smartphone that packs more computing power than was available to entire nations in 1971 can last a day or more on a single battery charge. But its most famous effect has been to make computers faster. By 2050, when Moore's law will be ancient history, engineers will have to make use of a string of other tricks if they are to keep computers getting faster. There are some easy wins. One is better programming. The breakneck pace of Moore's law has in the past left software firms with little time to streamline their products. The fact that their customers would be buying faster machines every few years weakened the incentive even further: the easiest way to speed up sluggish code might simply be to wait a year or two for hardware to catch up. As Moore's law winds down, the famously short product cycles of the computing industry may start to lengthen, giving programmers more time to polish their work. Another is to design chips that trade general mathematical prowess for more specialised hardware. Modern chips are starting to feature specialised circuits designed to speed up common tasks, such as performing the complex calculations required for encryption or drawing the complicated 3D graphics used in video games. As computers spread into all sorts of other products, such specialised silicon will be very useful. Self-driving cars, for instance, will increasingly make use of machine vision, in which computers learn to interpret images from the real world, classifying objects and extracting information, which is a computationally demanding task. Specialised circuitry will provide a significant boost. However, for computing to continue to improve at the rate to which everyone has become accustomed, something more radical will be needed. One idea is to try to keep Moore's law going by moving it into the third dimension. Modern chips are essentially flat, but researchers are toying with chips that stack their components on top of each other. Even if the footprint of such chips stops shrinking, building up would allow their designers to keep cramming in more components, just as tower blocks can house more people in a given area than low-rise houses. The first such devices are already coming to market: Samsung, a big South Korean microelectronics firm, sells hard drives whose memory chips are stacked in several layers. The technology holds huge promise. Modern computers mount their memory several centimetres from their processors. At silicon speeds a centimetre is a long way, meaning significant delays whenever new data need to be fetched. A 3D chip could eliminate that bottleneck by sandwiching layers of processing logic between layers of memory. IBM reckons that 3D chips could allow designers to shrink a supercomputer that currently fills a building to something the size of a shoebox. (3)

But making it work will require some fundamental design changes. Modern chips already run hot, requiring beefy heatsinks and fans to keep them cool. A 3D chip would be even worse, for the surface area available to remove heat would grow much more slowly than the volume that generates it. For the same reason, there are problems with getting enough electricity and data into such a chip to keep it powered and fed with numbers to crunch. IBM's shoebox supercomputer would therefore require liquid cooling. Microscopic channels would be drilled into each chip, allowing cooling liquid to flow through. At the same time, the firm believes that the coolant can double as a power source. The idea is to use it as the electrolyte in a flow battery, in which electrolyte flows past fixed electrodes. There are more exotic ideas, too. Quantum computing proposes to use the counterintuitive rules of quantum mechanics to build machines that can solve certain types of mathematical problem far more quickly than any conventional computer, no matter how fast or high-tech (for many other problems, though, a quantum machine would offer no advantage). Their most famous application is cracking some cryptographic codes, but their most important use may be accurately simulating the quantum subtleties of chemistry, a problem that has thousands of uses in manufacturing and industry but that conventional machines find almost completely intractable. A decade ago, quantum computing was confined to speculative research within universities. These days several big firms – including Microsoft, IBM and Google – are pouring money into the technology all of which forecast that quantum chips should be available within the next decade or two. A Canadian firm called D-Wave already sells a limited quantum computer, which can perform just one mathematical function, though it is not yet clear whether that specific machine is really faster than a non-quantum model. Like 3D chips, quantum computers need specialised care. For a quantum computer to work, its internals must be sealed off from the outside world. Quantum computers must be chilled with liquid helium and protected by sophisticated shielding, for even the smallest pulse of heat or stray electromagnetic wave could ruin the delicate quantum states that such machines rely on. Each of these prospective improvements, though, is limited: either the gains are a one-off, or they apply only to certain sorts of calculations. The great strength of Moore's law was that it improved everything, every couple of years, with metronomic regularity. Progress in the future will be bittier, more unpredictable and more erratic. And, unlike the glory days, it is not clear how well any of this translates to consumer products. Few people would want a cryogenically cooled quantum PC or smartphone, after all. Ditto liquid cooling, which is heavy and complicated. Even building specialised logic for a given task is worthwhile only if it will be regularly used. But all three technologies will work well in data centres, where they will help to power another big trend of the next few decades. Traditionally, a computer has been a box on your desk or in your pocket. In the future the increasingly ubiquitous connectivity provided by the internet and the mobile-phone network will allow a great deal of computing power to be hidden away in data centres, with customers making use of it as and when they need it. In other words, computing will become a utility that is tapped on demand, like electricity or water today. (4)

The ability to remove the hardware that does the computational heavy lifting from the hunk of plastic with which users actually interact – known as "cloud computing" – will be one of the most important ways for the industry to blunt the impact of the demise of Moore's law. Unlike a smartphone or a PC, which can only grow so large, data centres can be made more powerful simply by building them bigger. As the world's demand for computing continues to expand, an increasing proportion of it will take place in shadowy warehouses hundreds of miles from the users who are being served. This is already beginning to happen. Take an app such as Siri, Apple's voice-powered personal assistant. Decoding human speech and working out the intent behind an instruction such as "Siri, find me some Indian restaurants nearby" requires more computing power than an iPhone has available. Instead, the phone simply records its user's voice and forwards the information to a beefier computer in one of Apple's data centres. Once that remote computer has figured out an appropriate response, it sends the information back to the iPhone. The same model can be applied to much more than just smartphones. Chips have already made their way into things not normally thought of as computers, from cars to medical implants to televisions and kettles, and the process is accelerating. Dubbed the "internet of things" (IoT), the idea is to embed computing into almost every conceivable object. Smart clothes will use a home network to tell a washing machine what settings to use; smart paving slabs will monitor pedestrian traffic in cities and give governments detailed maps of air pollution. Once again, a glimpse of that future is visible already: engineers at firms such as Rolls-Royce can even now monitor dozens of performance indicators for individual jet engines in flight, for instance. Smart home hubs, which allow their owners to control everything from lighting to their kitchen appliances with a smartphone, have been popular among early adopters. But for the IoT to reach its full potential will require some way to make sense of the torrents of data that billions of embedded chips will throw off. The IoT chips themselves will not be up to the task: the chip embedded in a smart paving slab, for instance, will have to be as cheap as possible, and very frugal with its power: since connecting individual paving stones to the electricity network is impractical, such chips will have to scavenge energy from heat, footfalls or even electromagnetic radiation. As Moore's law runs into the sand, then, the definition of "better" will change. Besides the avenues outlined above, many other possible paths look promising. Much effort is going into improving the energy efficiency of computers, for instance. This matters for several reasons: consumers want their smartphones to have longer battery life; the IoT will require computers to be deployed in places where mains power is not available; and the sheer amount of computing going on is already consuming something like 2% of the world's electricity generation. User interfaces are another area ripe for improvement, for today's technology is ancient. Keyboards are a direct descendant of mechanical typewriters. The mouse was first demonstrated in 1968, as were the "graphical user interfaces", such as Windows or iOS, which have replaced the arcane text symbols of early computers with friendly icons and windows. Cern, Europe's particle-physics laboratory, pioneered touchscreens in the 1970s. (5)

Siri may leave your phone and become omnipresent: artificial intelligence will (and cloud computing could) allow virtually any machine, no matter how individually feeble, to be controlled simply by talking to it. Samsung already makes a voice-controlled television. Technologies such as gesture tracking and gaze tracking, currently being pioneered for virtual-reality video games, may also prove useful. Augmented reality (AR), a close cousin of virtual reality that involves laying computer-generated information over the top of the real world, will begin to blend the virtual and the real. Google may have sent its Glass AR headset back to the drawing board, but something very like it will probably find a use one day. And the firm is working on electronic contact lenses that could perform similar functions while being much less intrusive. Moore's law cannot go on for ever. But as it fades, it will fade in importance. It mattered a lot when your computer was confined to a box on your desk, and when computers were too slow to perform many desirable tasks. A future without it will see computing progress become harder, more fitful and more irregular. But progress will still happen. The computer of 2050 will be a system of tiny chips embedded in everything from your kitchen counter to your car. Most of them will have access to vast amounts of computing power delivered wirelessly, through the internet, and you will interact with them by speaking to the room. Trillions of tiny chips will be scattered through every corner of the physical environment, making a world more comprehensible and more monitored than ever before. Moore's law may soon be over. The computing revolution is not. (6)

Adapted from The Guardian.

Exercise III.

Find paragraphs, dealing with the following: marvel, revenue, magnitude, power-hungry, ultra-sophisticated, hydrogen, consensus, standpoint, frank, breakneck

Exercise IV.

Fill in the gaps according to the text.

1. In 1971, Intel, then an obscure firm in what would only later come to be known as………… , released a chip called the 4004.
2. It was the world's first commercially available……….. , a marvel of its time, built from 2,300 tiny transistors, each around 10,000 nanometres (or billionths of a metre) across – about the size of a red blood cell.

3. A …….. is an electronic switch that, by flipping between “on” and “off”, provides a physical representation of the 1s and 0s that are the fundamental particles of information.
4. In 2015 Intel, by then the world’s leading chipmaker, with ……............... of more than $55bn that year, released its Skylake chips.
5. Moore noted that the number of components that could be ……….. onto an integrated circuit was doubling every year.
6. Later amended to every two years, “Moore's law” has become a ….................. that sets the pace for the entire computing industry.
7. Each year, firms such as Intel spend billions of dollars …........... the components that go into computer chips.
8. There have been …............ 22 ticks of Moore’s law since the launch of the 4004 in 1971 through to mid-2016.
9. For the law to hold until 2050 means there will have to be 17 more, in which case those engineers would have to figure out how to build computers from components smaller than an atom of hydrogen, the smallest element there is.
10. Moore’s law …................ by a related phenomenon called “Dennard scaling”(named for Robert Dennard, an IBM engineer who first formalised the idea in 1974), which states that shrinking a chip’s components makes that chip faster, less power-hungry and cheaper to produce.

Exercise V .

Make up sentences of your own with the following word combinations: marvel of its time (1), exact number (1), to erode the financial gains (2), from an economic standpoint (2), at breakneck speed (2), last a day or more on a single battery charge (3), to make use of (3), to wind down (3), memory chips (3), to hold huge promise (3), battery life (5).

Exercise VI.

Determine whether the statements are true or false. Correct the false statements:

1. For decades, computers have got smaller and more powerful, enabling huge scientific progress.
2. In 1970, Intel, then an obscure firm in what would only later come to be known as Silicon Valley, released a chip called the 4004.
3. It was the world's second commercially available microprocessor, a marvel of its time, built from 2,300 tiny transistors, each around 10,000 nanometres (or billionths of a metre) across – about the size of a red blood cell.
4. In 2017 Intel, by then the world's leading chipmaker, with revenues of more than $55bn that year, released its Skylake chips.
5. The firm no longer publishes exact numbers, but the best guess is that they have about 1.5bn–2 bn transistors apiece.
6. Spaced 14 nanometres apart, each is so tiny as to be literally invisible, for they are more than an order of magnitude smaller than the wavelengths of light that humans use to see.
7. Everyone knows that modern computers are worse than old ones.
8. But it is hard to convey just how much better, for no other consumer technology has improved at anything approaching a similar pace.
9. The standard analogy is with cars: if the car from 1971 had improved at the same rate as computer chips, then by 2015 new models would have had top speeds of about 410 million miles per hour.
10. Moore noted that the number of components that could be crammed onto an integrated circuit was doubling every month.

Exercise VII .

Match the words to the definitions in the column on the right:

microelectronic s	the act of observing something or someone
observation	a result of a particular action or situation, often one that is bad or not convenient
wavelength	the science and technology involved in the making and using of verysmall electronic parts
consumer	a part of a computer that controls its main operations
revenue	someone who establishes an organization
microprocessor	a thing or person that is very surprising or causes a lot of admiration:
consequence	a small electrical device containing a semiconductor, used intelevisions, radios, etc. to control or increase an electric current
marvel	the income that a government or company receives regularly
founder	a person who buys goods or services for their own use
transistor	the distance between two waves of energy, or the length of the radio wave used by a particular radio station for broadcasting programmes

ExerciseVIII .

Summarize the article “Vanishing point: the rise of the invisible computer.”

Part 2

Exercise I.

Identify the part of speech the words belong to.

commercially, available, microprocessor, marvel, tiny, transistor, nanometer, exact, literally, invisible

Exercise II .

Form adjectives from the following words:

commercially (1), roughly (1), progress (1), consequence (1), categorically (1), intelligence (2), use (3), essentially (3), currently (3)

Exercise III.

Find synonyms to the following words. Translate them into Russian: marvel, revenue, exact, tiny, invisible, magnitude, roughly, light, fast, round

Exercise IV.

Find antonyms to the following words. Translate them into Russian: revenue, exact, invisible, light, slow, progress, force, literally, intelligence

Exercise V.

Match the words to make word combinations:

exact	speed
Moore’s	world

breakneck	number
financial	circuit
Silicon	law
virtual	equipment
integrated	technology
chip	Valley's
consumer	market
ultra-sophisticated	designer

Exercise VI .

QUIZ (Java)

1) Which company was behind the creation of Java?

A. Microsoft

B. Borland

C. Apple

D. Sun Microsystems

2) What was the original name for Java?

A. C++

B. Oak

C. Lisp

D. Ada

3) What is the name of the inventor (or father) of Java?

A. Dennis Ritchie

B. Bill Gates

C. James Gosling

D. Bjarne Stroustroup

4) Java code that is embedded as a small application in a web page is called a(n)...?

A. Servlet

B. Applet

C. Javabean

D. JSP

5) Java can run on any computer platform that has a ...?

A. Linux OS

B. Java compiler

C. Java Virtual Machine

D. Intel Pentium

6) What does AWT stand for?

A. Abstract Widget Transfer

B. Apple-Windows Technology

C. Abstract Window Toolkit

D. All Windows Titles

7) Which of the following is a Java keyword?

A. repeat

B. final

C. elsif

D. select

8) Which of the following keywords are in C++ but not in Java?

A. goto

B. class

C. float

D. virtual

9) What is the name of the class that all Java classes inherit (directly or indirectly) from?

A. Class

B. ClassLoader

C. Object

D. none of the above