

ACJC General Paper
2016 JC2 Preliminary Exam Comprehension Answer Scheme

1. What common assumption about the 'robotics revolution' does the author refute in paragraph 1? **Use your own words as far as possible.** (2)

From Passage	Paraphrased
The term 'robotics revolution' evokes images of the future: a not-too-distant future , perhaps, but an era surely distinct from the present. (lines 1-2)	It is a common assumption that the era of the robotics revolution could happen in time to come/soon/has not happened yet.
In fact, that revolution is already well under way . (line 2)	In reality, the revolution is already happening/ongoing.

2. Explain the author's use of the word 'even' in line 5. **Use your own words as far as possible.** (1)

From Passage	Inferred
But the exciting, even seductive appeal of these technological advances has overshadowed deep, sometimes uncomfortable questions about what increasing human-robot interaction will mean for society. (lines 5-7)	<p>The use of 'even' emphasises/highlights that the attraction to technological advances is so/extremely/very exciting to the extent/point of being alluring/enticing/irresistible.</p> <p>OR</p> <p>The use of 'even' shows that the attraction is more than just exciting / goes beyond being exciting; It can be alluring/enticing/irresistible.</p> <p><i>Note: 'Even' is used for adding a more extreme word or phrase to emphasise what was just said.</i></p>

3. Why has the author placed the word 'upbringing' (line 34) in inverted commas? (1)

From Passage	Inferred
Its behaviour over time will be a function of its original programming mixed with the influence of its environment and 'upbringing' . (lines 33-34)	<p><u>Function</u> The word is not used conventionally/in its usual/original sense.</p> <p><i>Incorrect: sarcasm, irony, the writer disagrees/disapproves with the use of the word</i></p> <p><u>Context</u> Robots are inanimate objects but the author is likening robots to people who could be conditioned/socialised/raised by their families or society.</p>

4. According to the author, what will robots with 'true agency' (line 44) be able to do? **Use your own words as far as possible.** (2)

From the passage	Paraphrased
...need to concentrate on investing robots with true agency. (lines 43-44) If we are going to live in a world with machines which act more and more like people and which make ever more 'personal' choices ... (lines 45-47)	Robots with true agency will be able to make decisions for themselves/independent decisions.
...then we should insist that robots also be able to communicate with us about what they know, how they know it and what they want... (lines 47-48)	They would also be able to articulate/express their thoughts.

5. According to the author, what are the factors that determine 'conventional human prowess' (line 51)? **Use your own words as far as possible.** (1)

From Passage	Paraphrased
To date, hybrid performance has mostly fallen short of conventional human prowess...the ability to perform complex mathematical calculations...might one day depend not solely on innate skill and practice ... (lines 50-54)	Conventional human prowess is determined by intrinsic/inherent/inborn/natural ability. ...and hard work/drill/training. <u>Note:</u> 2-part answer for 1 mark

6. In paragraph 8, what similarities does the author foresee between genetic engineering and robotics? **Use your own words as far as possible.** (2)

From the passage	Paraphrased
...a set of ethical problems: just as a fine line separates genetic engineering from eugenics, so, too, is there no clear distinction between robotics that would lift a human's capabilities to their organic limit and those that would vault a person beyond all known boundaries.... (lines 56-59)	In both cases, there is little/minimal difference between the moral and immoral uses of these technologies. OR In both cases, there is little/minimal difference between how they can help us reach the full potential of our natural abilities and how they can violate ethical norms.
Such technologies have the potential to vastly magnify the already-significant gaps in opportunity and achievement that exist between people of different economic means . (lines 59-61)	Both can greatly worsen/aggravate/exacerbate the rich-poor divide/income inequality/disparity.

7. Explain the differences between the conventional economy and the digital economy in paragraph 9. **Use your own words as far as possible.** (2)

From Passage	Paraphrased
Conventional interactions between consumers and firms are based on direct economic exchanges ... (lines 64-66)	In the conventional economy, firms do business in one-on-one/ straightforward transactions with consumers. OR In the conventional economy, firms profit from the buying and selling of goods.
...while firms profit not by directly charging consumers but by collecting and then monetising information about consumers' behaviour, often without their knowledge or acquiescence. (lines 67-69)	In the digital economy, firms do business in a roundabout way. OR In the digital economy, firms profit from selling consumers' data.
...consumers pay for goods and services, and firms provide them. (lines 64-66)	In the conventional economy, consumers give money to a firm which supplies/offers the goods and services
In the digital economy, however, consumers benefit more and more from seemingly free service (lines 66-69)	In the digital economy, consumers appear to be charged nothing/are not really charged for the goods and services.

8. What does the Google example in paragraph 9 tell us about the extent of data collection in the digital economy? **Use your own words as far as possible.** (2)

From Passage	Paraphrased/Inferred
This kind of basic data mining has become commonplace : think, for example, of how Google analyses users' search histories and e-mail messages... (lines 69-70)	It tells us that data collection in the digital economy is widespread/prevalent/rampant OR frequently/regularly/usually/normally done.
As more automation technologies begin to appear in the physical world, such processes will become even more invasive . (lines 72-73)	...and has become more intrusive/violates /encroaches on our personal privacy

9. In paragraph 10, explain why increased interactions with robots will erode our sense of identity. **Use your own words as far as possible.** (2)

From Passage	Paraphrased
Every day, we will encounter robots... with and without human remote control ... (lines 75-77) ...daily life will involve constantly interacting with machines without knowing just how much another person might be involved in the machine's response . (lines 77-78)	When it becomes difficult to determine the degree/extent of human input/influence over robots, increased interactions with robots will erode our sense of identity...
There will be no room in such infinitely adjustable human-robot systems for us to treat robots one way and humans another ... (lines 78-79) ...each style of interaction will infect the other... (line 80)	...because it would also be impossible to regard/relate to/deal with robots and humans differently. OR ...because we will have to regard/relate to/deal with humans and robots in the same manner. OR ...because humans will be dealt with the same way as robots. (Thus causing us to lose our sense of identity.)

10. What should inventors do to prevent the creation of 'a robot dystopia' (line 82)? **Use your own words as far as possible.** (2)

From Passage	Paraphrased
Inventors must begin to combine technological ingenuity ... (line 84)	Inventors should integrate technological creativity/innovation/originality...
...with sociological awareness , (lines 84-85)	...with insights of society/understanding of the world.
...and the inventors, in turn, must pledge to create more transparent artificial beings . (lines 89-90)	Inventors should make/design robots which are able to communicate clearly/easily understood. OR Inventors should make/design robots which will not withhold secrets from human beings/are able to communicate honestly/openly with human beings.
	1-2pts = 1m; 3pts = 2m

11. Using material from paragraphs 2 to 5, summarise the possible negative consequences of robotic technology and the limitations of robot regulation. Write your summary in **no more than 120 words**, not counting the opening words which are printed below. **Use your own words as far as possible.** (8)

Robotic technology could possibly lead to...

Possible negative consequences of robotic technology			
1	But they also have the potential to produce dystopian outcomes. (line 10) We are hardly on the brink of the nightmarish futures... (line 11)	1	Robotic technology could possibly lead to... ...apocalyptic /horrific/ terrible outcomes.
2	Intelligent machines attempt to enslave (line 12)	2	Robotic technology may subjugate/make subservient/control/oppress,
3	or exterminate humans (line 12)	3	or decimate/annihilate/kill all humankind.
4	the robotic future will involve dramatic trade-offs (line 13)	4	The use of robotic technology will involve drastic/extreme compromise/sacrifices (for the sake of benefits)...
5	...they (tradeoffs) could lead to a collective identity crisis over what it means to be human. (line 14)	5	...that will lead people to question what it means to be a person/our sense of who we are.
6	The trouble is that the rich traditions of moral thought that guide human relationships... (lines 16-17)	6	(Well-established) values/ethics/principles that instruct us on how to behave...
7	...have no equivalent when it comes to robot-to-human interactions. (lines 17-18)	7	...will become inapplicable/inadequate/irrelevant/ will be lacking in robot-human interaction.
8	Robots themselves have no innate drive ... (line 18)	8	(context) Robots will not have the natural/inherent/inborn inclination/motivation/impetus...
9	to avoid ethical transgressions (line 18)	9	...to avoid moral violations
10	...regarding privacy (line 19)	10	...concerning our personal space / confidential life
11	...or the protection of human life (line 19)	11	...or one's safety.
Limitations of robot regulation			
12	But the pace of change in robotics is far outstripping the ability of regulators and lawmakers to keep up (lines 27-28)	12	There are limitations to robot regulation because... the rate at which robotics is transforming is faster than what regulators can deal with.
13	...especially as large corporations pour massive investments ... (line 29)	13	(context) Robot regulation is difficult as big businesses put in large amounts of money...
14	...into secretive robotics projects that are nearly invisible to government regulators (lines 29-30)	14	...into confidential/clandestine robotics projects OR ...into robotics projects that are hidden from the government.
15	...this gap between robot capability and robot regulation will widen every year, (lines 31-32)	15	Robot regulation is difficult because the divide/chasm between what robots can do and the rules governing them will increase with time/ enlarge as time goes by.
16	...posing all kinds of quandaries for law and government. (line 32)	16	This divide creates conundrums/dilemmas for the legal system/government
17	It would be difficult for existing liability laws to apportion responsibility if such a machine caused injury (line 35-36)	17	It will be hard for current laws to judge/determine accountability/guilt if accidents happen...
18	Its behaviour over time will be a function of its original programming ... (lines 33-34) Since its actions would be determined not only by computer code ... (line 36)	18	...because the robot's actions are controlled by its software design/algorithm...
19	mixed with the influence of its environment and "upbringing" . (line 34) ...but also by a deep neural-like network that it would have learned from various sources . (lines 36-37)	19	...and they are affected by their surroundings /family/society.

No. of Points	1-2	3-4	5-6	7	8-9	10-11	12-13	14+
Marks	1	2	3	4	5	6	7	8

12. Illah Nourbaksh discusses the potential benefits and problems of robotic technology. How relevant are the author's views about the robotic future to you and your society?

Requirement:

Students should -

- a) explain the roles robotics already play in your own society and in the foreseeable future
- b) describe the possible benefits and problems of having an increased usage of robotics in society
- c) show understanding and engage with the ideas and views raised in the passage
- d) support your views with relevant examples from your own society

Explanation:

Discuss some of the following in relation to your own society:

- a) robotics and its impact on your economy, lifestyles and culture
- b) robotics and how it might affect your relationships with other people
- c) robotics and how you would perceive and treat robots
- d) who would be most and least affected by the robotic revolution
- e) what are the long term and short term effects as robotics becomes more pervasive
- f) how the effects of robotics could be managed by the government, companies and even ordinary people

Evaluation:

- a) question/show reasons for subscribing/not subscribing to the author's ideas
- b) provide insightful analysis of why the changes robotics brings are beneficial or harmful to society
- c) provide cogent development of arguments
- d) give examples from your own society to support your views

Coherence:

- a) adopt a consistent viewpoint
- b) argue logically
- c) organise answers into cohesive, themed paragraphs
- d) link paragraphs to show continuity and direction of argument
- e) maintain relevance to the task in everything they write
- f) end with a summative or concluding paragraph / sentence

References (Key Ideas)	Guiding Questions / Discussion Issues	Potential benefits of a robotic future / A robotic future will not pose a problem	Potential problems of a robotic future
But the exciting, even seductive appeal of these technological advances has overshadowed deep, sometimes uncomfortable questions about what increasing human-robot interaction will mean for society (lines 5-7).	<p>What are the effects of increased human-robot interaction on your society?</p> <p>To what extent will your society be able to deal with the negative effects?</p>	<p>The negative effects will not overwhelm the positive outcomes of robotics technologies. There might be some job losses but with our pragmatic, paternalistic and efficient government, such negative impact will be anticipated and dealt with, especially with the numerous initiatives to upgrade and reskill workers in the light of increasing automation.</p> <p>In fact, automation is needed to maintain Singapore's economic competitiveness. The National Robotics Programme has been launched to overcome a tight labour market and increase productivity. Reputed to be a government with great foresight, the government is likely to fully capitalise on the benefits of robotics to help it deal with manpower shortage which has arisen due to Singapore's ageing population, low birth rates and resentment for foreign workers.</p>	<p>Indeed, there will be some adverse effects when these technologies become widely used in Singapore, chief of these adverse effects will be job losses especially in the more labour-intensive industries such as manufacturing and hospitality. Robotics will be pervasive in the future as the government has announced in the 2016 Budget debate that it will be spending \$450 million on a National Robotics Programme to drive the development and deployment of robotics technology in both the private and public sectors.</p> <p>In addition, as robots become more commonly used, problems may arise from the unfair comparison between the productivity of robots and humans. The fact that robots do not need breaks for meals and will not fall sick, and that they are available at the beck and call of the employers, will definitely put unfair pressure on human employees.</p>
Robotic technologies that collect, interpret, and respond to massive amounts of real-world data on behalf of governments, corporations, and ordinary people will unquestionably advance human life. But they also have the potential to produce dystopian outcomes. (lines 8-10)	<p>What will be the advantages and disadvantages of having real-world data managed by robots in your society?</p> <p>How might robotic technologies improve life for your society?</p> <p>Why might robotics lead to something as extreme as a dystopia?</p>	<p>Currently, the massive collection of data has contributed to the security in Singapore and has improved efficiency and convenience. For e.g., if a person needs to update his change of address, all he has to do is to update it at the neighbourhood police post and it will be automatically updated in all government offices. With robotic technology that can better compute such data in the near future, the government ministries and offices can analyse the personal particulars of all citizens in huge databases and observe patterns of social behaviour to aid governmental planning.</p> <p>Moreover, in Singapore hospitals, with greater compilation of medical information, doctors will have greater access to the medical histories of patients. Robotic technology can even help to analyse the patients' health risks. This will make it much easier for doctors to provide more precise treatment for the patients as the information becomes more centralised and available to all doctors.</p>	<p>Currently, the massive collection of data has compromised our privacy and increased the government's surveillance on citizens. In the future, such surveillance will only become more intrusive. E.g. Government databases contain personal particulars and confidential information of citizens. While this may prove useful in applying for government schemes or services, the government could also easily retrieve such information to monitor citizens in order to maintain their influence and power. In the future, it may be even easier to trace the whereabouts of citizens or subject them to more intense scrutiny, much like the Orwellian dystopia described in the novel 1984.</p>

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<p>But those dark fantasies contain a seed of truth: the robotic future will involve dramatic trade-offs, some so significant that they could lead to a collective identity crisis over what it means to be human. (lines 12-14)</p> <p>There will be no room in such infinitely adjustable human-robot systems for us to treat robots one way and humans another; each style of interaction will infect the other, and the result will be an erosion of our sense of identity. (lines 79-81)</p>	<p>When robots become more entrenched, how might this affect your identity as humans?</p> <p>Is your society likely to accord robots certain rights and treat them as equals?</p>	<p>Even though there will be more and more robots in our midst, it is very unlikely that it will pose a serious challenge to our identity as humans. Being well educated and also well exposed, Singaporeans are likely to be aware and will actively differentiate between humans and robots. In a Straits Times survey conducted recently, almost all the participants said that they preferred robots that looked mechanical and did not resemble humans. Thus, being practical and realistic, the ubiquity of robots is not likely to culminate in Singaporeans either questioning the meaning of being human or in an apocalyptic outcome.</p> <p>As our country aims to reach its goal of becoming a Smart Nation, it is inevitable that intelligent robots will permeate our lives. However, over time, with sufficient exposure and acclimatisation, people will become accustomed to living with robots, and perhaps a new identity will emerge rather than erode. Ten thousand primary and secondary school students are expected to benefit from a new S\$2.8 million dollar Robotics & Maker Academy (RMA) collaboration between the Infocomm Development Authority of Singapore (IDA) and Singapore Polytechnic. These students will gain the necessary computational thinking skills and basic understanding in coding and robotics. With such a foundation in learning how to manage robotics, robots will become incorporated into who we are as a people.</p>	<p>Having life-like robots permeate our lives could lead to confusion for people, especially children and the aged, who may not know how to react to such a human-like machine interacting with them on such an intimate level. Physical social robots are poised to become more visible in offices and homes in future. For e.g. the Nanyang Technological University's (NTU) Institute for Media Innovation recently unveiled Nadine, a female humanoid companion with a personality, who is able to remember people and hold conversations with them. She looks almost like a human being, with soft skin and flowing brunette hair. She smiles when greeting you, looks at you in the eye when talking, and can also shake hands with you. Ostensibly, Nadine could be deployed as a companion for the young and the elderly. This can be very disconcerting, even disturbing, for people because the robot is not quite human, but appears to have so many human-like traits. In aesthetics, this is called the "uncanny valley" which hypothesises that human replicas that appear almost but not exactly like real human beings elicits feelings of eeriness and revulsion among some observers.</p> <p>Additionally, this could lead to an identity crisis over what it means to be human, and perhaps even induce young children who cannot differentiate between a real and artificial being to prefer the company of robots to humans, having been under a robot's care for so long. Human relations are complicated, but human-robot ones are not, because they are merely subservient to what we want.</p>
<p>Robots now share the formerly human-only commons, and humans will increasingly interact socially with a diverse ecosystem of robots. The trouble is that the rich traditions of moral thought that guide human relationships have no equivalent when it comes to robot-to-human interactions. (lines 15-18)</p>	<p>Why are traditions of moral thought inadequate to guide your society in its robot-human interactions?</p> <p>What kinds of human-robot interactions could emerge which could potentially be controversial?</p> <p>Should your society develop a new moral framework?</p>	<p>Singapore is firmly rooted in traditional values despite the advances in robotics. Such values will continue to guide our decision-making. And while robotics might be new, that does not mean that we will lose our moral compass just because there is no precedence for robotics. E.g. The Singapore government has always regarded the well-being of citizens as one of its topmost priorities. Therefore, much thought will go into the design of robotics and their impact to our society.</p>	<p>Indeed, there might not be adequate moral guidelines for robot-to-human interactions. Given the pragmatism of Singapore government and its people, economic survival and competitiveness have always been prioritised over ethical concerns. Take for example Singapore government's decision to go ahead with stem cell research even though there were ethical issues about the use of foetuses in the harvesting of the stem cells.</p> <p>Furthermore, drones or unmanned aerial vehicles have been introduced into our 3rd Generation Singapore Armed Forces (SAF) in an effort to modernise the army and reduce reliance on human troops. However, there has been little or no debate over the possible ethical conundrums of programming a drone to kill for instance, or even a regulatory body to provide ethical guidelines in</p>

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			robot programming. What if the drone deviates from its programming and accidentally kills innocent civilians? The Singapore government has yet to consider these potential ethical problems that may arise.
<p>“transhumanism” refers to a post-evolutionary transformation that will replace humans with a hybrid of man and machine. (lines 49-50)</p> <p>The ability to perform complex mathematical calculation, produce top-quality language translation, and even deliver virtuosic musical performances might one day depend not solely on innate skill and practice but also on having access to the best brain-computer hybrid architecture. (lines 52-55)</p>	<p>What might this prove to be attractive or harmful?</p> <p>Could transhumanism be divisive in society?</p> <p>What will happen when computers become better than humans in previously exclusive human tasks such as the arts?</p> <p>Will computers enhance our capabilities or corrupt us?</p>	<p>In the medical sector, patients who suffer from coronary heart diseases and who have lost limbs are fitted with pacemakers and prostheses. There are others who, though not impaired, are also looking forward to adopting such technology into their bodies. There is a high chance that more advanced robotics technology could be introduced for people to enhance their ability. E.g. Hope Technik, a local technology company, is designing a prototype of an exoskeleton that could have military, logistical, and healthcare uses. In the near future, perhaps it would not be uncommon or even surprising to witness a melding of man and machine. In fact, it can offer raise productivity and offer more hope for those who are physically incapacitated.</p> <p>Furthermore, Singapore’s technological superiority and highly competitive society could lead to a high demand for computer chips that could amplify one’s intelligence and competencies, should these become commercially available.</p>	<p>While therapeutic applications of robotics technology such as the use of prostheses may be less controversial, it poses a problem if it is used to augment one’s abilities. There are legitimate fears that we might be creating a group of superhuman race and introducing more fault lines in society. One cannot deny that it is very likely to incite protests and objections from ethicists to conservatives.</p>
<p>Such technologies have the potential to vastly magnify the already-significant gaps in opportunity and achievement that exist between people of different economic means. (lines 59-61)</p>	<p>Why will robotics magnify social inequality in your society?</p> <p>What can be done in your society to ameliorate this?</p>	<p>Singapore’s education system is of a world-class standard and has proven itself to be highly adaptable to economic changes, enabling the next generation to upgrade their skills (The government will set up TechSkills Accelerator, a new skills development and job placement hub, to help workers in the information and communications technology sector learn new skills quickly) and make good use of new technologies to become more economically productive and employable. Robotics will become a useful assisting work-tool like present-day computers and the Internet to enhance our general productivity, and make Singapore more competitive than our neighbours, ensuring our continued economic success. Granted, there will always be some who will fall between the cracks, but this will only consist of a small minority.</p>	<p>Singapore’s GINI coefficient is already one of the world’s highest. This is likely to worsen because only the well-off would be able to afford using robots even as the well-educated will have the expertise to work alongside robots. Those who do not fall into these categories, who only have their labour and limited skills to offer, will be easily replaced by robots and become unemployable in this new economy. Lucy, a robot waitress, which delivers food at Rong Heng Seafood restaurant at East Coast Seafood Centre, was a test-bed to evaluate its usefulness. The Singapore government is making \$400 million available to support and encourage SMEs to automate. This might make less skilled workers become obsolete and unemployable, thus widening the income gap.</p>

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<p>In the digital economy, however, consumers benefit more and more from seemingly free service, while firms profit not by directly charging consumers but by collecting and then monetising information about consumers' behaviour, often without their knowledge or acquiescence. (lines 66-69)</p> <p>As more automation technologies begin to appear in the physical world, such processes will become even more invasive. (lines 73-74)</p>	<p>Is this a good strategy for businesses to use to make money from robotics?</p> <p>Why is privacy such a concern?</p> <p>How can this problem be resolved?</p> <p>How can people in your society learn to be more receptive to robots entering human spaces more?</p> <p>Why is it crucial for your society to adapt?</p>	<p>Although some apps and related technologies do not provide full disclosure of their privacy policies, often Singaporeans are not concerned. They are primarily concerned with how useful and functional the apps are, and see the giving up of their privacy as an equitable exchange in return for the free use of a good app. The advertisements that get displayed on one's social media in response to the personal information gathered can be easily bypassed. Hence, many people accept this form of business because they have intentionally chosen not to be fully aware of how the companies utilise their personal information.</p> <p>As more users become more informed about their privacy, they will become more prudent in giving out their private information when making agreements with companies, and as a response to concerns people have, the Singapore government will set up various policies to restrict companies from abusing the private information of their clients such as the Personal Data Protection Act (PDPA).</p>	<p>It has been found that currently, 90% of mobile apps in Singapore do not adequately declare what consumer data is collected or how it is used, potentially falling foul of Singapore's Personal Data Protection Act (PDPA). Yet, more than half of the mobile apps that people download seek access to swathes of sensitive information, such as users' online and social media identities and location. This is a severe breach of personal privacy and it will get worse if robotic technology becomes even more efficient at data collection. What companies do with the information collected is often shrouded in secrecy. People will not be able to identify the specific sources of breaches in their privacy, so the government may not be able to stop this completely.</p> <p>Singaporeans are always keen to get a good deal and may not realise the price they are paying for it. Most people who sign up for free software or services online would not read the user agreements to grant the companies full access to their personal data carefully or they are unaware of its implications. Hence they will receive a rude shock when they start getting more targeted advertising and calls soliciting their business. Given that this business model is set to become more pervasive due to its success, Singaporeans can expect to have more of their private data intruded upon, unless they have a greater awareness.</p>