THINKING SKILLS   **9694/32**

Paper 3: Problem Solving and Critical Thinking (Advanced)   **October/November 2010**

1 hour and 15 minutes

Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on the Answer Booklet/Paper in the space provided unless this has been done for you.

Write in dark blue or black pen.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE ON ANY BARCODES.

Electronic calculators should be used.

There are **20** questions on this paper. Answer **all** the questions. Each question has two parts.

For each part of the question there are five possible answers **A**, **B**, **C**, **D** and **E**. Select the **one** answer you think is correct for that part.

Record your choice(s) in the separate Answer Booklet/Paper.

Start each question on a new line.

INFORMATION FOR CANDIDATES

Each question is worth 2 marks. Marks will not be deducted for wrong answers.

This document consists of **22** printed pages and **2** blank pages.

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

1 **(i)** Which **one** of the following is an argument?

(ii) Which **one** of the following is an explanation?

A Honey could soon be marketed as a way to combat the effects of ageing. However, we should be sceptical. The research to support this shows only that rats fed honey are less anxious and have better memories. This research was funded by a dairy company interested in sweetening yoghurt with honey.

B Last year, maintenance workers at Santa Clara University in California struggled for weeks with a blockage of the drains in the arts and sciences building. Eventually they spotted the problem: a pink iPod had been accidentally flushed by a student.

C Little animals live fast and die young, while big ones lead more leisurely lives. It is only recently that research has been done to show that there is the same relationship in plants as in animals. Trees live longer and reproduce slowly, while plankton do not live long and reproduce very quickly.

D Small animals die younger than big ones because they have a higher metabolic rate. For example, a dog that is sixteen times larger than a rat will use only about eight times as much energy.

E Women's education is the single most important factor in addressing problems of explosive population growth. World population already exceeds 6 580 000 000. More than half of these people live in cities.

2 During 2003, a US President and his advisors looked at NASA's future and made two recommendations: to replace the ageing Space Shuttle by the year 2010 with the new spacecraft, the Orion; and to return humans to the Moon by 2020. Now NASA's future is being reinvented yet again. President Obama suggests that the agency is suffering from a "sense of drift" and has commissioned a new enquiry. But what does he expect the enquiry to recommend? However much I admire President Obama's style, I regret his failure to state what he, personally, would like NASA to achieve. The leadership of US space policy has to come directly from the President, not from yet another commission. NASA is still achieving little – after 5 years of work nothing is ready to fly. Meanwhile thousands of Space Shuttle workers are being laid off as the Space Shuttle heads towards retirement. As we recall the triumphs of the 1960s project, it is sobering to realise that NASA's morale is at the lowest ebb today since the 1986 Challenger disaster.

(i) Which **one** of the following expresses the main conclusion of the above argument?

A NASA is currently achieving little.

B NASA's future is being reinvented again.

C NASA's morale is at its lowest ebb.

D Obama has failed to state what he wants NASA to achieve.

E The US President himself should direct space policy.

(ii) What function is performed by the following in the above argument?

"…after 5 years of work nothing is ready to fly."

A Analogy

B Evidence

C Example

D Explanation

E Intermediate conclusion

3 Since 1972 UNESCO* has designated 890 sites of World Heritage – sites of cultural, natural or other significance which are protected and preserved. But as each generation forms its own culture and values, how can we be sure that we are preserving the right things? If we retain too much, we risk crowding future generations with the cultural litter of the past, but if we retain too little, we can risk creating a generation unaware of their past. The only way that we can hope to create a balance is to regularly review Heritage sites. Fundamentally we should remember that every generation should build on the achievements of the past, and we must ensure that there is room for them to do so.

*United Nations Educational, Scientific and Cultural Organization

(i) Which **one** of the following best expresses the author's use of the term 'cultural litter' in the above argument?

A Buildings deemed by a generation to have no architectural or cultural value outside their own time.

B Evidence of culture which each generation inherits from their ancestors.

C Objects which have not been properly disposed of and therefore form part of a culture.

D Products of a society or culture which have little or no value, but have not been disposed of.

E Waste items of no value produced by a society.

(ii) What function is performed by the following sentence in the above argument?

"Fundamentally we should remember that every generation should build on the achievements of the past and we must ensure that there is room for them to do so."

A Analogy

B Counter-claim

C Example

D General principle

E Main conclusion

4 Studies have shown that cycling to work helps keep you fit and contributes significantly to keeping your weight down. However, factors such as diet are still important in maintaining one's health as some effects of diet, such as the build up of cholesterol, will not be helped through exercise. This means one should still avoid eating too much cholesterol-producing food such as cheese. There is also considerable evidence that the effect on fitness of lifestyle choices, such as what we eat and how much exercise we get, might be outweighed by the effect of a person's genetic inheritance; ironically, a person who has taken great care to make the right lifestyle choices may still die prematurely of a heart attack because there was a history of heart disease in the family. However, it must remain true that cycling to work is a good idea, so you should leave the car in the garage and start using pedal power if you want to contribute to your overall health.
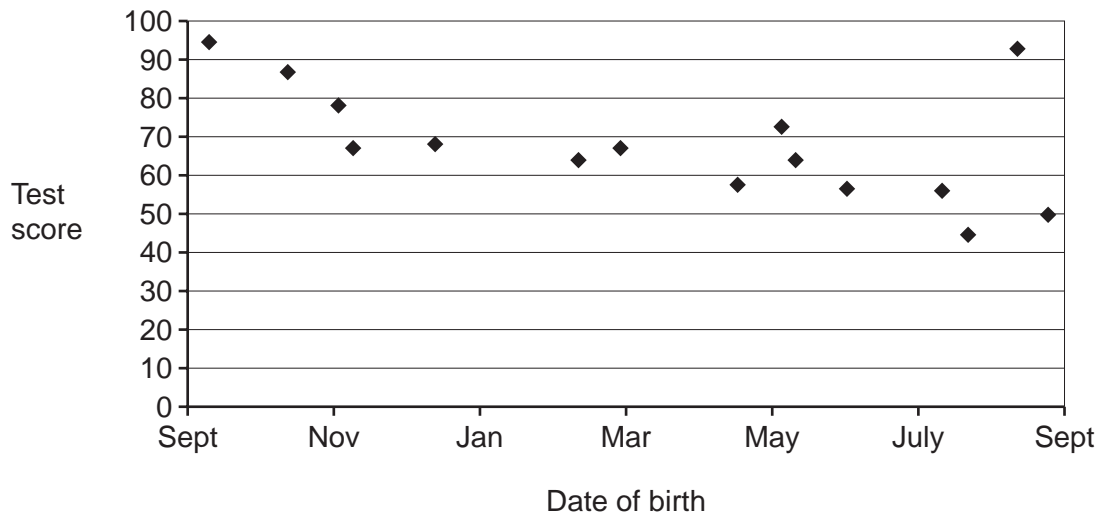
(i) Which **one** of the following is a statement of the flaw in the above argument?

A It fails to consider that cycling may not be the cause of fitness.

B It fails to consider that cycling might not be sufficient to ensure fitness.

C It fails to consider that cycling might not be the only way to get fit.

D It fails to consider what risks are involved in cycling.

E It fails to consider whether people want to be fit.

(ii) Which **one** of the following pairs of terms are conflated in the above argument (i.e. assumed to mean the same thing but in fact refer to different things)?

A Cycling/exercise

B Cycling/pedal power

C Fitness/health

D Ill health/disease

E Ill health/injury

5 The graph below shows the average test scores for a group of 15 students in their fourth year in education in relation to their date of birth. All students have received the same amount of formal education. Their school year begins in September.

(i) Which **one** of the following statements provides an explanation for the results shown by the graph?

A Children born earlier in the school year are less advanced when they start school.

B Children born earlier in the school year are more advanced when they start school.

C Children born later in the school year have greater social skills than those born earlier.

D Children born later in the school year often achieve more highly than their peers in formal examinations.

E Children who have their birthday earlier in the school year are less intelligent than those with later birthdays.

(ii) If the graph above is typical of a sample from the general population, which **one** of the following statements is NOT a conclusion that could be drawn from the graph above?

A Being born in September or October presents some children with an advantage in their schooling.

B Children born in August and July do not achieve as highly as those born in September and October.

C Children whose birthdays fall in the months between March and August may have to work harder to achieve as highly as their peers.

D Children who have birthdays earlier in the school year could be more likely to become 'high achievers'.

E The month in which a child is born may have an effect on their attainment in education.

6 On May 1st Prudence started saving 20¢ and 50¢ coins together in a large jar. Every day, without fail, she added 10 coins to the jar.
During the first week of September the jar became full and Prudence emptied it out to count how much she had saved. She was surprised to discover that the total value of the 20¢ coins was exactly the same as the total value of the 50¢ coins.

(i) On what date did the jar become full?

A September 2nd

B September 3rd

C September 4th

D September 5th

E September 6th

(ii) How much had Prudence saved altogether?

A $252

B $360

C $441

D $522

E $630

7 Those intrepid racing car drivers Michel Cobbler and Austin Buckle are having another exciting battle at the Francoring, a track 4 km around. As Michel completes his 20th lap, Austin is 1 km behind. Michel is currently lapping at 1 min 20 sec per lap, but Austin is flying at 1 min 16 sec per lap.


refuelling area

start / finish
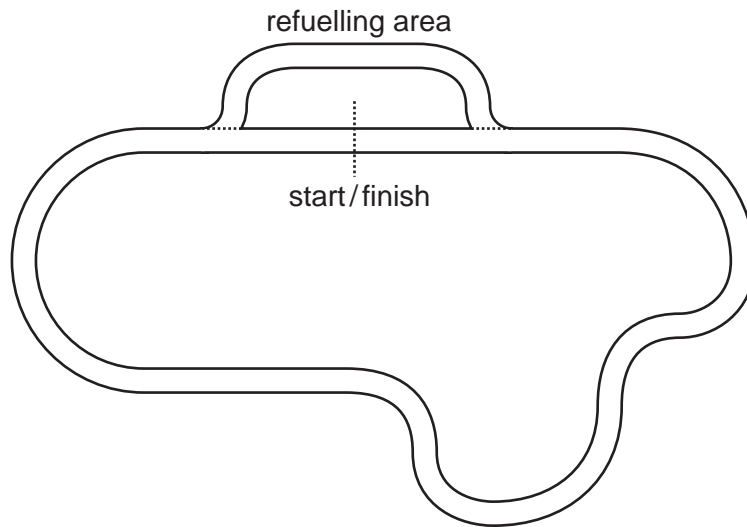
(i) If they continue at the same rate, how much further will Michel Cobbler have to drive before he is caught?

A 4 ¾ laps

B 5 laps

C 5 ¾ laps

D 19 laps

E 20 laps

When Michel has completed his 20th lap he has 10 more laps to complete. Unfortunately Austin Buckle must stop to refuel at the end of his 24th lap. This will cause him to lose 21 seconds and his lap times will be 2 seconds slower after he has refuelled.

(ii) What will be the relative positions at the end of the race?

A Michel Cobbler wins by 24 seconds.

B Michel Cobbler wins by 20 seconds.

C Michel Cobbler wins by 12 seconds.

D They finish equal.

E Austin Buckle wins by 9 seconds.

8 Consider the following plan of an indoor play area, made of square rooms nested inside square rooms:
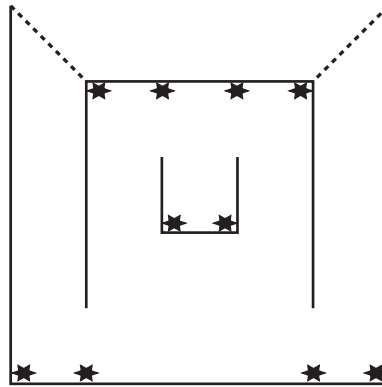
Each of the smaller rooms is exactly in the centre of the surrounding room. The dotted lines represent the two entrances to the play area.

Imagine that you wished to install security cameras in the maze, to ensure that all parts of it could be seen. The black stars represent where the cameras could be installed.

There is no limit to how far the cameras can see, but they have an angle of vision which is limited to 90°. The cameras themselves are very small.

(i) What is the minimum number of security cameras that could cover the entire maze?
You can assume that the cameras 'cast no shadow' themselves (i.e. you need not worry about areas being hidden from view behind a camera), and that the walls are thin enough to allow a camera to see areas on both sides of them if directed towards their ends.

(ii) If cameras were installed at all ten installation points above, what is the largest number of cameras one could be visible to at one time (assuming the cameras were faced in appropriate directions to see this 'maximally visible' spot)?

A 3

B 4

C 5

D 6

E 7

9 Use the following information to answer the questions below:

International Morse Code

1. A dash is equal to three dots.
2. The space between parts of the same letter is equal to one dot.
3. The space between two letters (or numbers) is equal to three dots.
4. The space between two words is equal to five dots.

A	● ▬		U	● ● ▬
B	▬ ● ● ●		V	● ● ● ▬
C	▬ ● ▬ ●		W	● ▬ ▬
D	▬ ● ●		X	▬ ● ● ▬
E	●		Y	▬ ● ▬ ▬
F	● ● ▬ ●		Z	▬ ▬ ● ●
G	▬ ▬ ●			
H	● ● ● ●			
I	● ●			
J	● ▬ ▬ ▬			
K	▬ ● ▬		1	● ▬ ▬ ▬ ▬
L	● ▬ ● ●		2	● ● ▬ ▬ ▬
M	▬ ▬		3	● ● ● ▬ ▬
N	▬ ●		4	● ● ● ● ▬
O	▬ ▬ ▬		5	● ● ● ● ●
P	● ▬ ▬ ●		6	▬ ● ● ● ●
Q	▬ ▬ ● ▬		7	▬ ▬ ● ● ●
R	● ▬ ●		8	▬ ▬ ▬ ● ●
S	● ● ●		9	▬ ▬ ▬ ▬ ●
T	▬		0	▬ ▬ ▬ ▬ ▬

(i) If a trainee Morse code operator allows one second for a 'dot' to be transmitted, how long would she take to transmit the word "MORSE"?

A 31 seconds

B 35 seconds

C 36 seconds

D 43 seconds

E 50 seconds

(ii) Consider the transmission of "ONE" as a word, compared to the transmission of "1" as a numeral. Which of the following describes the relationship between the two transmissions?

A   6 seconds shorter to transmit it as a word.

B   3 seconds shorter to transmit it as a word.

C   They take the same amount of time.

D   3 seconds shorter to transmit it as a numeral.

E   6 seconds shorter to transmit it as a numeral.

10 Three identical square-based pyramids, each with two faces at right angles to the base, are to be fitted together to make a cube.
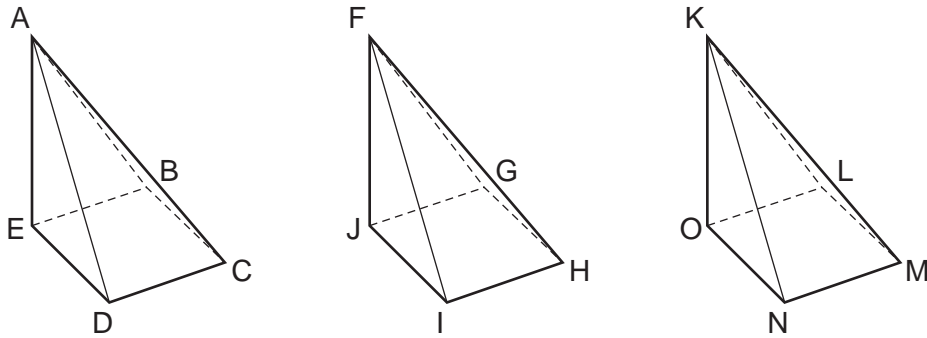
(i) Which one of these combinations of vertices could meet at a corner of the cube?

A A, F and K

B A, H and M

C A, G and K

D D, G and L

E D, I and L

A toy is to be made by attaching the three pyramids at the vertex found in the first part of this question. The toy manufacturer wants the cubes that result to be as colourful as possible, but doesn't want any of the external faces of the cube to have two colours on (from two differently coloured triangles meeting).

(ii) How many different colours can the manufacturer use to paint those faces of the pyramids which will show externally?

A 6

B 5

C 4

D 3

E 2

11 **(i)** Which **one** of the following passages is an argument?

   (ii) Which **one** of the following passages is an explanation?

   A In some countries, fee-paying schools exist in addition to those provided free by the state. This always leads to inequality between state schools and private schools. Inequality based on wealth should not be tolerated.

   B Opponents of universal state education have argued that imposing the same low level of education on all young people, and preventing any of them from rising above their peers, is a false idea of equality.

   C The reason why people desire wealth is so that they can buy valuable commodities for themselves and their families. Education is one such commodity. If parents were prevented from spending some of their money on giving their children a good start in life, they would be less motivated to work hard.

   D The suggestion that all children should be made to attend schools provided by the state is unacceptable, because everyone should be free to spend their own money in whatever way they choose.

   E Without education, the fundamental human rights of liberty and pursuit of happiness are very limited. This is why most countries have identified education as a human right.

12 It has long been claimed by advocates of healthy living and so-called natural lifestyles that organic foods are best. Many, in large parts of the world, have been taken in by this claim and spend large amounts of their income on organic meat, fruit and vegetables. This has created additional profits for supermarkets and food producers. However, the most recent scientific studies carried out on a large scale throughout the USA show that organic foods have no nutritional benefits by comparison with other foods. Thus organically grown vegetables contain almost exactly the same amounts of nutrients – including, importantly, vitamin C, calcium and iron – as conventional foods. There were slight differences detected in levels of nitrogen and phosphorous but these differences were of no nutritional significance. What was true of vegetables was also found to be true of meats and dairy products. Yet organic foods can typically cost 25% more than their conventional alternatives. Of course consumer choice is to be encouraged; but that choice needs to be properly informed. The truth is there is no health benefit to justify the extra cost of organic foods. Common sense should prevail and consumers and producers, everywhere, should be encouraged to switch back to conventional foods which are just as healthy and cheaper to produce.

(i) Which **one** of the following, if true, would most weaken the above argument?

A Conventional foods unlike organic foods are free from potentially harmful pesticides.

B Dangerous side effects with drugs and medicines can go undetected for many years.

C Not all organic foods cost 25% more than their conventional alternatives.

D Organic foods, unlike conventional foods, are free from potentially harmful pesticides.

E The studies showed that it is possible to grow organic foods which are resistant to fungal diseases and thus capable of high yields.

(ii) After hearing the argument, one listener made the following comment:

"The USA defines what counts as 'organic food' less strictly than nearly all other countries involved in the production and export of organic foods."

If true, does this comment

A give only a little support to the conclusion of the argument?

B neither strengthen nor weaken the argument?

C seriously undermine the argument?

D slightly weaken the argument?

E strongly support the conclusion of the argument?

13 A philosophy of animal rights has grown up which suggests there are ethical problems with keeping animals as 'pets'. Some have tried to get round this problem by calling pets 'animal companions' but, as is often the case, simply re-naming something doesn't alter the essential nature of what it is. The key problem is whether pets are treated as property and, if they are, is there something wrong in treating a living creature as property? Whilst many people would not want to go as far as banning pet ownership, some behaviour towards pets is a cause for concern. Some dog owners for instance dress their pets up and take them to dog grooming parlours; arguably this is rather close to treating them as a 'living doll'. Other animals seem unsuitable as pets because they have the possibility of a life in the wild e.g. rabbits, birds. So, we should not dismiss the views of those who would oppose pet ownership out of hand. Instead we should constantly question the nature of the relationship between ourselves and our pets, so that we can defend this relationship against the charges levelled at it.

(i) After reading the above argument, a student summarised the conclusion as follows:

"It is all right for us to treat pets as our property."

Has the student

A expressed the conclusion fairly and accurately?

B expressed the conclusion too strongly?

C identified the wrong part of the argument as the conclusion?

D misunderstood the conclusion?

E not expressed the conclusion strongly enough?

(ii) Which **one** of the following is a further conclusion that can be drawn from the above argument?

A Cruelty may not be the only ethical issue regarding animals.

B No living thing should be treated as property.

C People who keep pets want to feel they own the animal.

D Some living creatures should not be treated as property.

E There are no ethical problems involved in owning non-living things.

14 Everyone agrees that stealing is wrong – at least in principle. Everyone wants to live in a society where their property is protected by the law and criminals are rightly punished. If I were to see someone pick up my mobile phone and run off with it, I would expect the police to chase them and return it to me. You would expect the same if you saw someone run off with your phone or iPod. Yet young people in particular often see nothing wrong in looking over the shoulder of a fellow student in class without the other student knowing it and copying their work. Likewise many students are happy to copy passages from the Internet. Lawyers rightly talk of intellectual property rights. My mobile phone is just like any other of the same model, but intellectual property is uniquely the property of the one who created it in the first place. It is time we all started to be consistent in this matter. Students who copy essays should be identified as common thieves and legally prosecuted.

(i) Which **one** of the following best expresses the sense in which the author is using the term 'stealing' in the argument?

A To take and use what does not belong to you without the other person's permission.

B To take or use what does not belong to you without the other person's knowledge.

C To take or use what does not belong to you without the other person's permission.

D To take what does not belong to you by force or deception.

E To use what does not belong to you without permission.

(ii) Which **one** of the following best expresses the sense in which the author is using the term 'property' in the argument?

A Property is what cannot be taken from me.

B Property is what I create using my own talents and intelligence.

C Property is what is protected by copyright.

D Property is what the law prevents people from taking from me.

E Property is what the law should prevent people from taking from me.

15 In a move sure to cause major arguments in the conservation world, the UN Food and Agriculture Organisation (FAO) and the Centre for International Forestry Research (CIFOR) have released a report suggesting that there is no link between deforestation and major floods. While the report acknowledges that forests can play a role in minimising run-off that causes local flooding, it states that there is no scientific evidence that deforestation significantly contributes to severe widespread flooding. As well as controlling deforestation, other options for flood prevention should be considered. A senior forestry officer for FAO's Asia and Pacific office states, "Government decision makers, international aid groups and the media are often quick to blame flooding on deforestation caused by small farmers and loggers. The conclusion is not only wrong scientifically, but such misguided views have in the past prompted governments to make life harder for poor farmers, by driving them off their lands and away from the forests while doing nothing to prevent future flooding."

(i) Which **one** of the following expresses the main conclusion of the above argument?

**(ii)** Which **one** of the following is an assumption underlying the above argument?

A Forested areas help to prevent flooding during heavy rainfall.

B Forests do not play a role in minimising the run-off of water during heavy rainfall.

C Government decision makers, international aid agencies and the media are each prompted by their own self-interest.

D Policy-makers should consider other options for flood-prevention in addition to controlling deforestation.

E There are other viable methods available to prevent widespread flooding.

16 An assessment system in a school has various increasing levels of attainment, e.g. 5, 6, or 7. Children are supposed to know their targets, which is no small challenge when the parents find it hard to understand.

The teachers predict how likely they consider someone is to get a particular level rather than the one below. A rating of '6.3' is taken to indicate a 30% chance of getting a 6 rather than a 5.

(i) If the teachers are correct, what is the average (mean) level of those rated 6.3?

(ii) What is the most likely (modal) level of those rated 6.3?

A   5

B   5.3

C   5.8

D   6

E   6.3

17 Sven is a music teacher who visits schools in 6 towns as shown below:
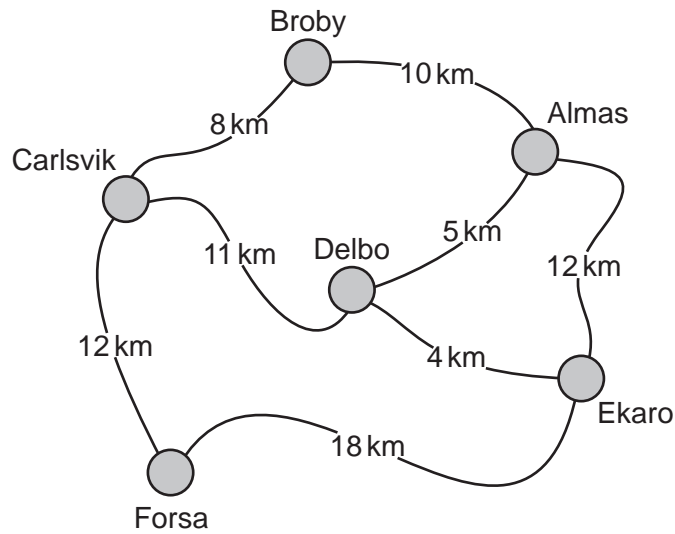
One day he has to visit a school in Almas in the morning and one in Forsa in the afternoon.

(i) Which is the shortest route from Almas to Forsa?

A Via Broby and Carlsvik.

B Via Delbo and Carlsvik.

C Via Delbo and Ekaro.

D Via Ekaro only.

E Via Ekaro, Delbo and Carlsvik.

(ii) How many different routes could he take back from Forsa to Almas without visiting any town twice?

A 4

B 5

C 6

D 7

E 8

18 A Swedish pre-paid travelcard provides a 10% discount on fares. There is a minimum top-up fee of 200 Kr, and I started by loading my card with just 200 Kr.

Having spent 168 Kr of the money stored on the card, I now find that top-ups can only be made in multiples of 100 Kr. I had planned to make only five more journeys, with each one costing 120 Kr if paid with cash, or 108 Kr if I use the discount card. Anything left over at the end will be wasted as I'll be leaving and cannot give it to anyone else.

(i) How much should I add to the card to minimise my total travel costs?

(ii) What would be the best top-up option for someone who has already bought a card with the minimal 200 Kr and wants to make just six of the same 108/120 Kr journeys?

A 0 Kr

B 200 Kr

C 400 Kr

D 500 Kr

E 600 Kr

19 Striped ties sold in Europe almost always slope from the left shoulder to the right hip, whereas those sold in the US almost always slope the other way.
Not surprisingly, the American in our group only has one European-style and nine American-style ties, whereas the German has one American-style and eleven European-style ties.

Both my American and German colleagues pick their ties at random.

(i) When they arrive together with ties sloping in different directions, what is the chance that the new secretary will correctly guess which one is the American?

A 99 in 120

B 100 in 120

C 9 in 10

D 20 in 22

E 99 in 100

(ii) Most surprisingly, the next day they each arrive with their tie sloping the opposite way from the day before. The doorman had observed the two colleagues entering the building on both days. If he makes a guess on the second day only, what is the chance that he will correctly guess which one is the German?

A 9 in 20

B 1 in 2

C 11 in 20

D 9 in 10

E 11 in 12

20 Telescopes now come with software which picks out the brightest three stars, and from the angles of the resulting triangle they can work out which stars they are, and thus exactly in which direction they are pointing. Each circle in the diagram below shows the field of view for one setting of a telescope.

In the first position shown below the stars labelled A, B and C are used. In the second position it uses D, E and F.
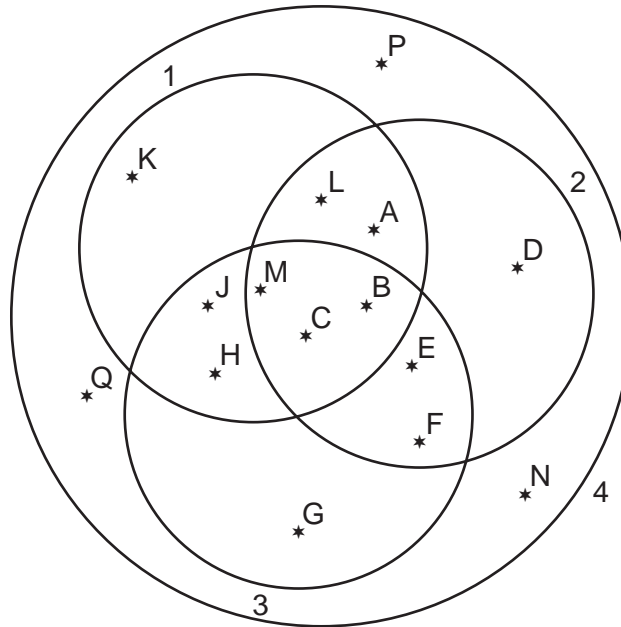
(i) Which **one** of the following sets could be the three stars used in the third position?

A CFG

B EFH

C EFG

D BEJ

E GHJ

(ii) The zoom was then changed to the fourth position.

Which **one** of the following sets could be the stars used?

A DEG

B DMK

C GHJ

D ADK

E DGK

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