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**THINKING SKILLS**

**9694/13**

Paper 1 Problem Solving

**May/June 2016**

**1 hour 45 minutes**

Additional Materials: Multiple Choice Answer Sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

\* 2 6 2 9 0 6 5 9 8 8 \*

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**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

There are **30** questions on this paper. Answer **all** the questions.

For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in pencil on the separate answer sheet.

**Read very carefully the instructions on the answer sheet. Ignore responses numbered 31 – 40 on the answer sheet.**

DO **NOT** WRITE IN ANY BARCODES.

**INFORMATION FOR CANDIDATES**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

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This document consists of **17** printed pages and **3** blank pages.

- 1 Philip had invited seven friends to join him on a golfing holiday. On each day the eight people would be put into four pairs so that two matches could be played. He wanted to make sure that everyone would be paired with everyone else once and play against everyone else twice. Mark was able to arrange it so that they could play all of the matches in seven days, with everyone playing just one match each day.

Another friend wants to join the holiday. Mark says that to arrange all the matches now, it will be necessary for each person to have one day on which they do not play golf.

How many more days will they need for the holiday in order to include the extra friend?

- A 1
- B 2
- C 8
- D 9

- 2 In 1991 the 26 cantons of Switzerland celebrated their 700th anniversary by devising a new national walking trail around the southern edge of Lake Lucerne. It has a total length of 35 km. The path is divided into sections which represent each of the cantons. The order of these sections reflects the date that the canton joined the confederation. Thus the first four sections represent Uri, Schwyz, Nidwalder and Obwalden, the founding cantons.

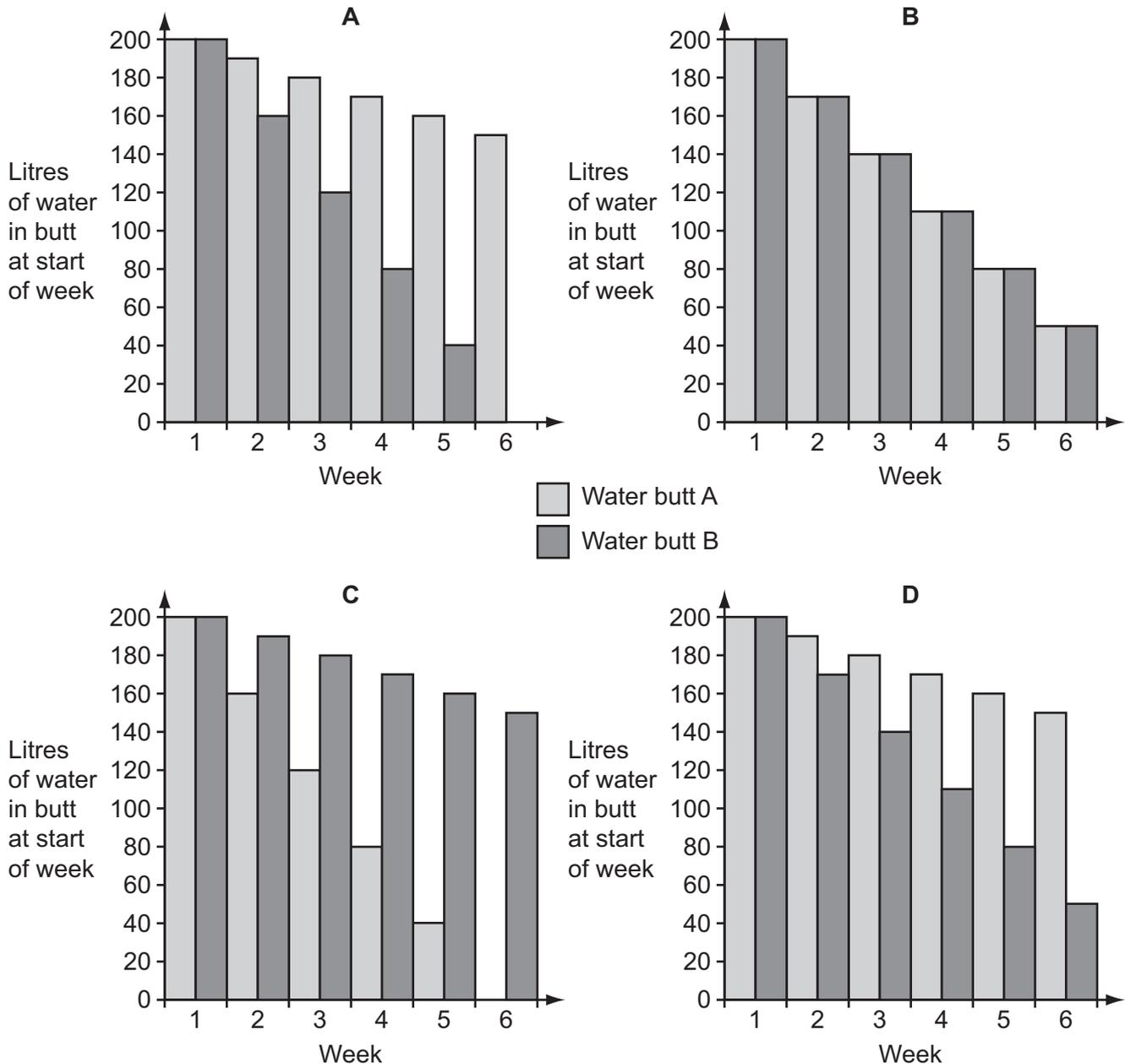
The length of each section of the path reflects the canton's population in 1991. Thus the longest section of path, representing Zurich, the most populous canton, is 6.1 km long. The total population of Switzerland in 1991 was 7 000 000. Each citizen was represented by a small length of path. The least populous canton in 1991 was Appenzell. Its path is 71 metres long.

What was the population of Appenzell?

- A 1420
- B 14 200
- C 35 500
- D 71 000

- 3 In the spring Julie uses rainwater to water her plants. She collects this in two 200-litre water butts. She collects the water from the roofs of her two greenhouses. She uses twice as much from the greenhouse at the bottom of the garden (butt B) than from the one at the top of the garden (butt A). She uses an average of 90 litres of water per week and both water butts are full at the beginning of spring. The rainfall in her area in early spring is enough to replenish each butt by 20 litres each week.

Which of these graphs represents the volume of water in Julie's two water butts at the beginning of each of the first six weeks of spring?



- 4 A league consists of 24 teams who play each other twice in a season. There are 3 points for a win, 1 point for a draw and 0 points for a loss. After 45 games the positions of the bottom 8 teams in the league table are as follows:

<i>Position</i>	<i>Teams</i>	<i>Games Played</i>	<i>Games Won</i>	<i>Games Drawn</i>	<i>Games Lost</i>	<i>Goals For</i>	<i>Goals Against</i>	<i>Goal Difference</i>	<i>Points</i>
17	Biddick	45	14	15	16	54	61	-7	57
18	Harlow	45	15	12	18	51	71	-20	57
19	Marsden	45	15	11	19	51	61	-10	56
20	Seaton	45	15	10	20	51	61	-10	55
21	Pelton	45	15	9	21	64	72	-8	54
22	Blackfell	45	14	12	19	54	68	-14	54
23	Welton	45	14	11	20	55	67	-12	53
24	Belmont	45	13	13	19	58	80	-22	52

The final games that affect these teams are:

Penshaw 1 – 0 Biddick  
 Hylton 2 – 0 Welton  
 Shields 4 – 1 Belmont  
 Esh 3 – 2 Pelton  
 Chester 1 – 0 Marsden  
 Harlow 2 – 2 Blackfell  
 Seaton 2 – 0 Seaham

What is the final position of the bottom 4 teams?

- A** 21 Pelton  
 22 Blackfell  
 23 Welton  
 24 Belmont
- B** 21 Pelton  
 22 Blackfell  
 23 Belmont  
 24 Welton
- C** 21 Blackfell  
 22 Pelton  
 23 Belmont  
 24 Welton
- D** 21 Blackfell  
 22 Pelton  
 23 Welton  
 24 Belmont

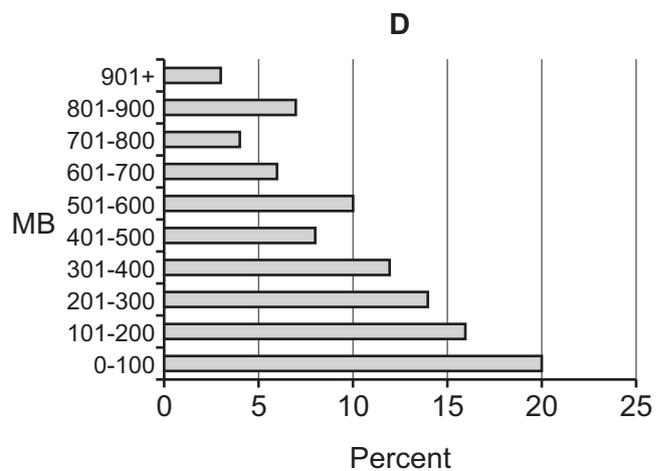
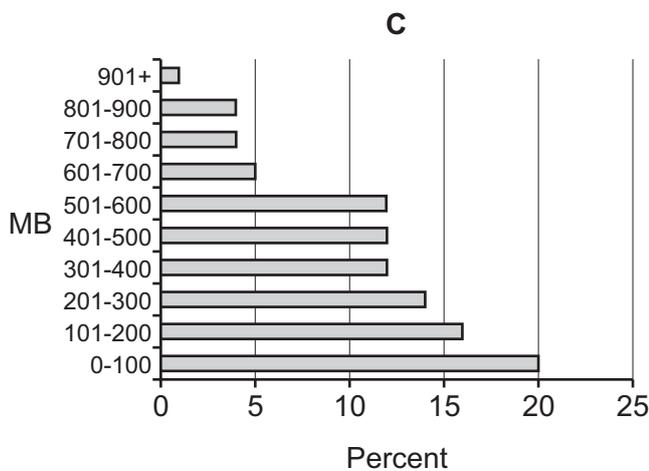
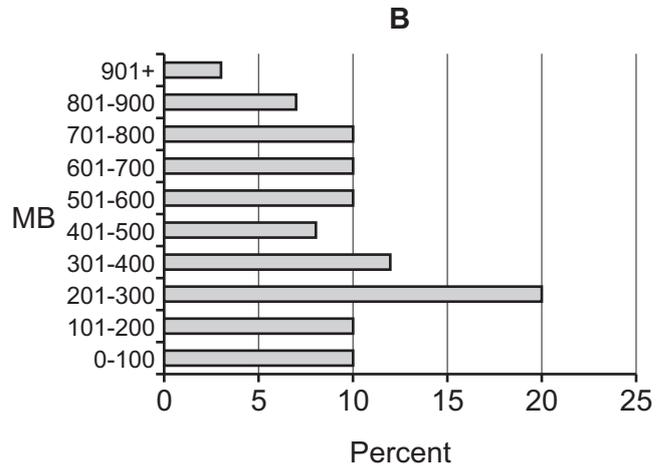
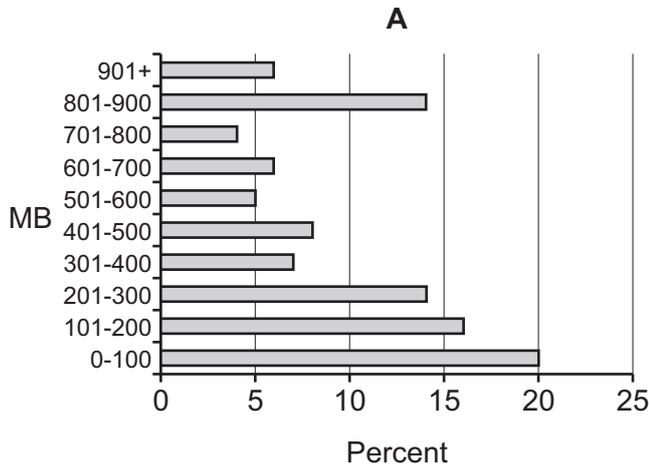
- 5 Two trains travel along adjacent straight parallel tracks from Angleborough to Bournemouth, which are 800 kilometres apart. Train A leaves Angleborough at 8.10am and travels at a constant 100 kilometres per hour to Bournemouth. Train B leaves Bournemouth one hour after train A has travelled 50 kilometres and travels at a constant 150 kilometres per hour towards Angleborough.

How far apart are the trains 1 hour before they pass each other?

- A 50 kilometres
- B 100 kilometres
- C 150 kilometres
- D 250 kilometres

- 6 On a mobile network, the amount of data transfer a customer uses each month is measured in megabytes (MB). Last month, 10% of customers used more than 800MB, while 70% used less than 500MB.

Which of the following represents this information?



- 7 My two grandchildren are coming to visit and I need them to complete the tasks in the following table. Each task can be completed by either grandchild and any task can be done at the same time as any other task. They cannot both work on the same task.

<i>Task</i>	<i>Time needed (minutes)</i>
Fix DVD player	6
Mend the lock on the gate	10
Mow the grass	13
Replace the kitchen light bulb	6
Screw a picture to the wall	6

What is the shortest time in which they can complete all the tasks?

- A 20 minutes  
 B 21 minutes  
 C 22 minutes  
 D 23 minutes
- 8 A survey asked everyone in a group of people if they could distinguish margarine from lard, and reported that 92% of them could do so.

Assuming that the figure is quoted to the nearest whole number, what is the smallest possible size of the group?

- A 12  
 B 13  
 C 23  
 D 25
- 9 *Tom's Taxis* charges \$3 per kilometre or part of a kilometre plus \$2 per five minutes or part of five minutes of journey time.

I have used *Tom's Taxis* twice today: to take me from my hotel to a business appointment this morning, and later to take me back to the hotel. The journey there was 6.2 kilometres, but because of heavy traffic it took 43 minutes. On the journey back the driver took a different route which, although it was 8.8 kilometres, only took 19 minutes.

How much less did I pay for the journey back than for the journey there?

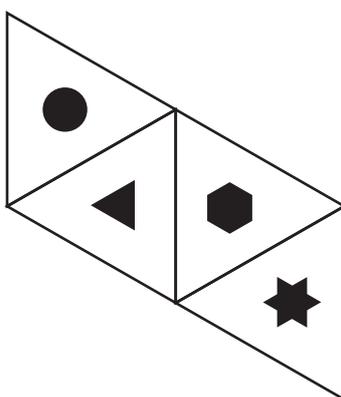
- A \$1  
 B \$4  
 C \$6  
 D \$9

- 10 Terry wants to photocopy a newsletter for his local golf club. He needs at least 40 copies. The newsletter has 2 sides, and will be printed in black and white, double sided. The prices for his local print shop are shown below.

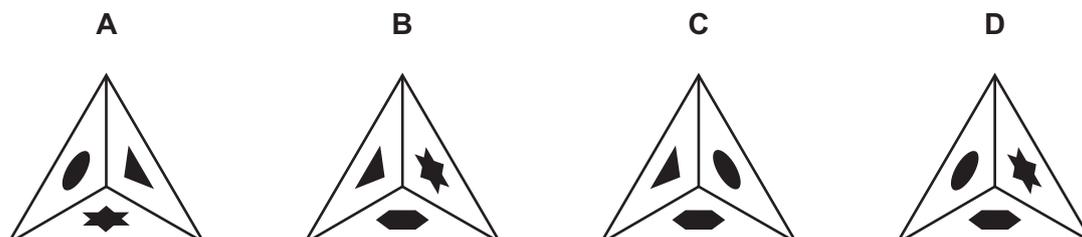
	<i>Black and White</i>	<i>Colour</i>
<i>Paper</i>	1¢ per sheet	10¢ per sheet
<i>Photocopying</i>	1–24	5¢ per side
	25–49	3¢ per side
	50–99	2¢ per side
	100	1¢ per side
Reduced prices for longer runs apply to all copies from number 1 onward		

What is the lowest price he will have to pay?

- A \$2.00  
 B \$2.50  
 C \$2.80  
 D \$3.20
- 11 The diagram below represents a net from which a die with four faces can be made to use in a children's game. When assembled the die becomes a tetrahedron (a regular triangular-based pyramid).



Which one of the following does **not** show a possible view of the assembled die as seen from above one vertex?



- 12** An internet site gave the following information: 67% of smokers had started by age 18, 84% by age 19. For an article, a journalist wants to know the percentage of the population that took up smoking between 18 and 19.

The following two pieces of information are available:

- i. The percentage of the population that smokes.
- ii. The total number of people that smoke.

Which of the following statements is correct?

- A** The additional information is not sufficient to calculate the value
  - B** i is sufficient to calculate the value
  - C** ii is sufficient to calculate the value
  - D** Neither i nor ii is sufficient on its own to calculate the value, but the two pieces of information together are
- 13** Three-day horse trials consist of a day of obedience testing (dressage), a day of timed cross-country riding and a day of show jumping.

A horse may be withdrawn because of injury at any time. During the cross-country event a horse can be retired by the rider or disqualified for failing at too many fences. Horses that take too long on the cross-country course, but are not disqualified, are given penalty points.

During a recent event at Burghley, there were only 3 horses without any cross-country penalty points at the start of the show jumping. These 3 were 10% of those taking part in the show jumping. Before the cross-country, 20% of the original entry had been withdrawn due to injury. During the cross-country, 40% of the remaining horses were retired and 10% were disqualified.

How many horses were in the original entry?

- A** 60
- B** 75
- C** 100
- D** 150

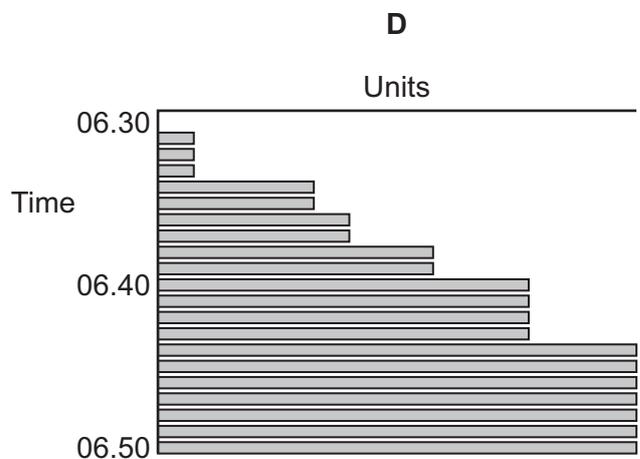
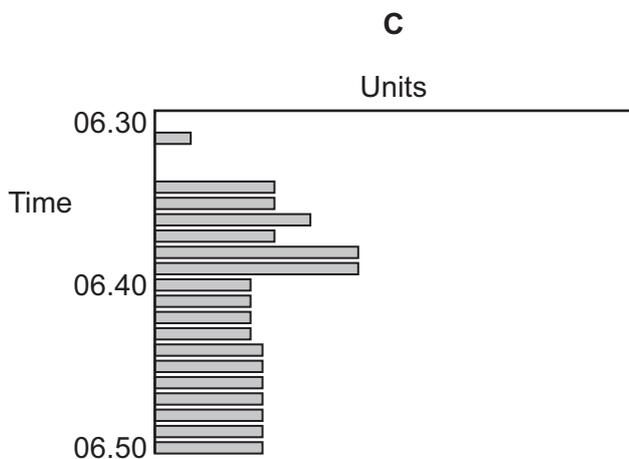
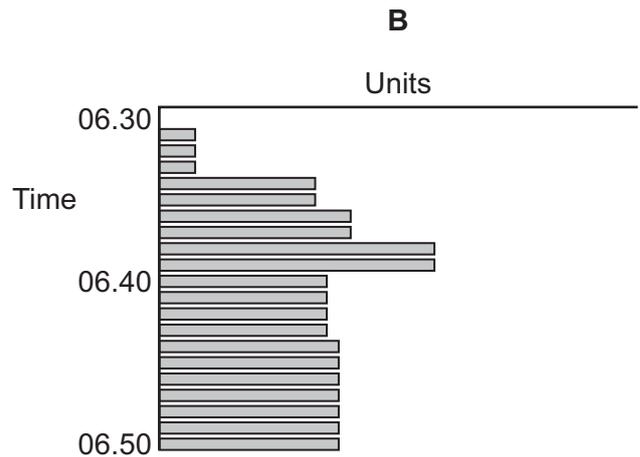
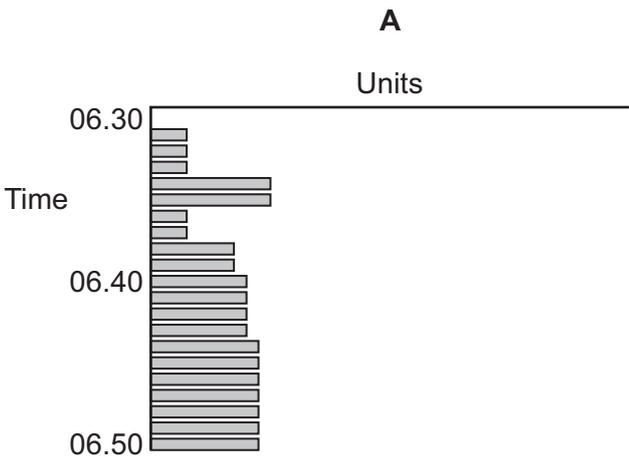
- 14 Some homes have been fitted with 'smart' energy display devices which allow householders to monitor energy usage.

The table below shows the energy consumption of various electrical devices in John's house.

<i>Device</i>	<i>Units per minute</i>
Kettle	7
Microwave	8
Room light	3
Shower	10
Television	9

Waking at 06:30, John switches the bedroom light on at 06:31. His wife switches on the shower at 06:34 and it remains on for 6 minutes. John switches on the kitchen light at 06:36. At 06:38 the kettle is switched on for 2 minutes. The microwave heats up the porridge for 4 minutes from 06:40 and the television is switched on at 06:44.

Which of the displays below best represents the energy consumption over this period?



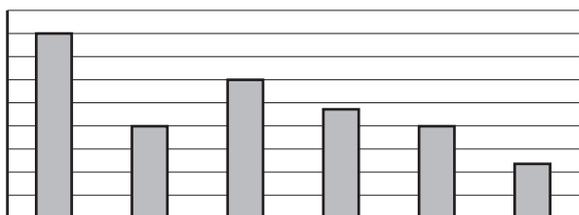
- 15 Six cars travelled the same journey and the rate at which they consumed fuel was compared. The table below shows the number of km each travelled for each litre of fuel used.

	km travelled for each litre of fuel
Car 1	12
Car 2	20
Car 3	24
Car 4	30
Car 5	20
Car 6	40

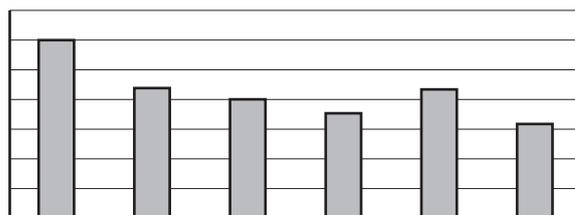
The fuel economy of the cars could also be compared simply by showing the total fuel used by each car on the journey.

Which of the following charts, if suitably labelled, could represent the total fuel used by each car, given the data in the table above?

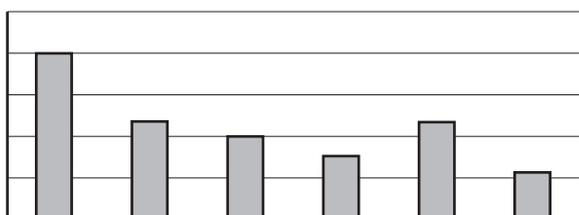
A



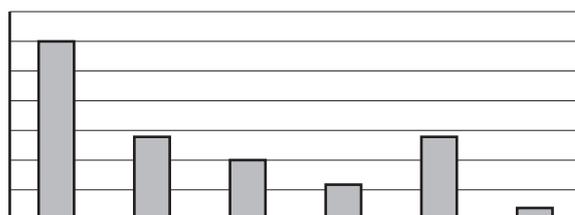
B



C



D



- 16** Matt writes and records his own songs. He has been asked to produce a CD of his songs. The CD is to be played throughout the course of an event. The event will last at least 2 hours and at most 3 hours and no song may be played more than three times. Each of Matt's songs lasts at least 2.5 minutes and at most 4 minutes.

What is the maximum number of different songs that Matt might have to include to ensure that all the conditions are met?

- A** 10  
**B** 15  
**C** 16  
**D** 24
- 17** As part of the process for appointing new members of staff, all applicants are required to take two tests. Test A has a maximum score of 15, while test B has a maximum score of 25. The applicants are only told their total score.

Any applicant who scores at least 12 on test A moves on to the next stage of the process, regardless of their score in test B.

Of the remaining applicants, those who score at least 15 on test B move on to the next stage of the process.

When Jeremy was told his total score, he was certain that he would move on to the next stage of the process.

What is the smallest possible total score that Jeremy could have been told?

- A** 25  
**B** 26  
**C** 27  
**D** 28

- 18** Here are three mobile phone tariffs.

<b>Alphacom</b>	<b>BigTel</b>	<b>Comwire</b>
\$20/month 100 mins free 20¢/min after	30¢/min for the first 100 min. Free thereafter	No contract! 25¢/min all day, every day!

For what range of monthly usage times is Alphacom cheapest?

- A** 0 to 80 minutes  
**B** 80 to 150 minutes  
**C** 100 to 160 minutes  
**D** more than 150 minutes



- 21** Jane needs to travel to visit a friend. If she uses the motorway then the journey will take her 30 minutes. However, if there is a lot of traffic she will not be able to go as quickly and the journey will take an extra 45 minutes. Alternatively, Jane could travel along the local roads. If there is not too much traffic then this route will take 45 minutes. There are three villages on this route where there may be a lot of traffic.

If there is a lot of traffic in Ashville then the journey time will be increased by 20 minutes.

If there is a lot of traffic in Oaktown then the journey time will be increased by 15 minutes.

If there is a lot of traffic in Elmport then the journey time will be increased by 5 minutes.

Jane is able to check the traffic conditions in each of the villages and on the motorway before she leaves. She assumes that the conditions will stay the same throughout her journey.

If she finds out that there is a lot of traffic on the motorway, which villages does Jane need to check so that she can choose the quickest route to visit her friend in every situation?

- A** Ashville and Oaktown
  - B** Ashville and Elmport
  - C** Oaktown and Elmport
  - D** Ashville, Oaktown and Elmport
- 22** Fred has a four-digit Personal Identification Number (PIN) for his card to draw money out of his bank account. All possible 10000 numbers are allowed. His bank has an unusual security system: it requires customers to get exactly one digit wrong each time, and not to use the same four-digit code as was used the previous time. Someone steals his card, but has no information about Fred's PIN.

How many numbers that the thief could try would be accepted as valid?

- A** 3
  - B** 4
  - C** 35
  - D** 36
- 23** My uncle Leech had to go for a blood test yesterday at the local hospital. The doors opened at 08:30 and nurses Nick, Jay, Kate and Drew started taking blood at 09:00. On arrival you take a numbered ticket that confirms your position in the queue. My uncle arrived shortly before 09:00 and acquired ticket number 70. Nurse Nick attends to one patient every 2.5 minutes, Jay one patient every 4 minutes, Kate one patient every 5 minutes and Drew one every 6 minutes.

Which nurse attended to Uncle Leech?

- A** Nick
- B** Jay
- C** Kate
- D** Drew

- 24 Charlotte is building a kennel for her dog. She needs a number of wooden planks. Specifically, she needs 12 of length 1.50 m, 6 of length 2.00 m, and 2 of length 4.00 m. She can obtain these by buying and cutting planks that come in lengths of either 5.00 m or 7.00 m. Each 5.00 m plank costs \$10 and each 7.00 m costs \$16.

She wants to get the planks she needs for the least possible cost, and realises that this may mean she has some pieces of wood left over from her cutting.

What will be the total length of wood that she buys but does not use?

- A 1 m  
B 2 m  
C 3 m  
D 4 m
- 25 Fred runs his own Christmas parcel collection and delivery service. He charges an amount that is made up of three parts:
- a basic cost of \$10 for the service;
  - a cost per parcel delivered;
  - a cost per km travelled between collection and delivery.

Last year Amy and Bianca both used Fred's service once. Amy posted 6 parcels to her cousin who lives 80 km away. Bianca posted 2 parcels to her sister who lives 50 km away. Amy had to pay twice as much as Bianca.

Which one of the following could **not** have been Fred's charges?

- A \$10 per parcel and \$0.50 per km  
B \$20 per parcel and \$1.50 per km  
C \$25 per parcel and \$2.00 per km  
D \$30 per parcel and \$3.00 per km

- 26 Mr and Mrs Carter have four children: Alfie, Bertie, Cally and Dal. Each child has a packet of crisps each weekday, Monday to Friday inclusive, in their lunchbox. Alfie and Bertie do not eat crisps at weekends, but Cally and Dal each have one packet every weekend. Alfie and Bertie only like Salt and Vinegar crisps, Cally only likes Smoky Bacon crisps and Dal always has Salt and Vinegar crisps in her lunchbox, but will eat any flavour of crisps at weekends. The following table shows the prices of crisps.

<i>Flavour</i>	<i>1 packet</i>	<i>Bag of 9 packets</i>	<i>Bag of 12 packets</i>
Plain	\$0.58	\$4.80	\$6.40
Salt and Vinegar	\$0.60	\$5.10	\$6.70
All others	\$0.70	\$6.00	\$7.55

Mrs Carter is going away for 21 days and she wants to buy **exactly** the right number of packets of crisps for her children for that length of time.

What is the lowest price that she will need to pay?

- A \$38.75  
 B \$38.80  
 C \$38.94  
 D \$39.05
- 27 John is about to sit his final examination. His overall mark for his course will be calculated by adding together 20% of his mark for the coursework, 30% of his mark for the first examination and 50% of his mark in the final examination. Students who have a total score of 80% are awarded a distinction. When John was told that he had scored 90% on the first examination he said, "If I have got the score I think I should have for my coursework then I only need to score 74% in the final exam to get my distinction."

What does John think that he scored in the coursework?

- A 76%  
 B 78%  
 C 80%  
 D 82%

- 28 An exhibit at the Emirst Art Gallery consists of 21 free-standing bricks, two of which have been painted black all over. They have been stacked into a vertical triangle, with six on the bottom row, then each successive row containing one brick fewer, tapering to one at the top. The whole exhibit is on a base that rotates continually, so that both sides are seen from the viewing position.

The Gallery has closed for the night, and the cleaner has accidentally knocked some of the bricks out of position. This is how the exhibit appears at present.



She knows that the overall shape resembles a triangle, but she can't remember where the other black brick was situated. However, she is certain that the two black bricks were **not** touching each other.

In an attempt to reconstruct the exhibit, how many distinguishably different appearances that **might** be correct has the cleaner got to choose from?

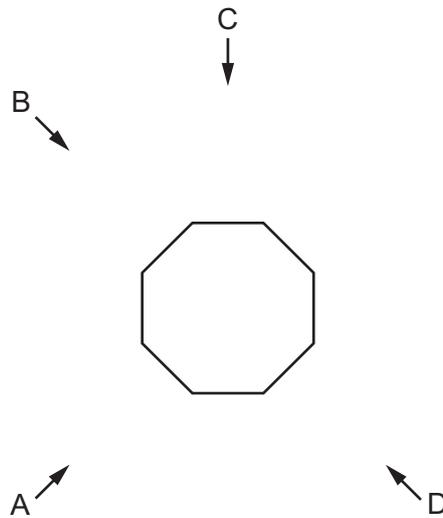
- A 4
  - B 6
  - C 7
  - D 8
- 29 The minute hand of one of my clocks travels faster 'downhill' than 'uphill'. It takes exactly 25 minutes to progress from 12 to 6, moving at constant speed, then takes exactly 36 minutes to return to 12 at a slower constant speed.

I reset the clock to the correct time every day at 12 noon (as shown by a clock that gives the correct time).

What time does the clock show every day at 12 noon, immediately before I reset it?

- A 11:36
- B 11:37
- C 11:40
- D 11:42

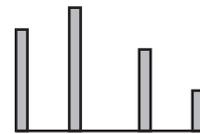
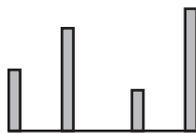
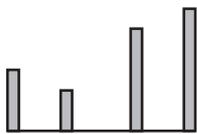
- 30 There are four security cameras looking at a small piece of modern art in the Lyle Gallery, from quite far away. The arrangement of the cameras around the artwork is represented in the sketch below.



The artwork consists of a regular octagon painted on the floor. At each of the eight corners there is an upright pole. Not all of the poles are the same height.

In the pictures from the security cameras, poles behind are obscured by the ones in front, and so the image only shows the height of the taller pole of each pair.

Only three of the cameras are working, and these are the images they show:



Which camera is **not** working?

- A Camera A
- B Camera B
- C Camera C
- D Camera D



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