INSTRUCTIONS

• Do not open the CAT paper until told to do so.
• Maintain silence at all times.
• Do not bring mobile phones into the room.
• You may use calculators and printed language dictionaries.
• You may NOT borrow equipment without a supervisor’s permission.
• There are 15 questions. Questions 1–6 are multiple-choice with five possible answers given. Questions 7–15 require a three-digit answer. Attempt all questions. Penalties do not apply.
• You are allowed working time of one hour (60 minutes). There is no extra reading time.
• This is a competition not a test; do not expect to answer all questions.
• Diagrams are NOT drawn to scale. They are intended only as aids.
• The questions have been thoroughly checked. Each question stands as written. No further explanation of questions can be provided.
• You must not leave your seat. If you have any other questions or problems, please raise your hand and wait for a supervisor.
• If you wish to leave the room a supervisor must accompany you.
• Record all your answers on the answer sheet provided.
• Use B or 2B lead pencils only. Ball point and ink pen markings may not activate the optical scanner.
• Do not make any other marks on the answer sheet as these may make the sheet unreadable.
• If you make an error, use a plastic eraser to completely remove all lead marks and smudges.
• Check the number of the answer you are filling in is the same as the number of the question you are answering. This is particularly important if you decide to leave a question blank.
• To ensure the integrity of the CAT and to identify outstanding students, the AMT reserves the right to re-examine students before deciding whether to grant official status to their score.
1. Hospital Symbols

A hospital uses symbols to record patient hair type.

For instance, the symbol ♥ would be used for a patient with brown, straight, long, thin hair.

How many of the following would have the same symbol as someone with thick, straight, long, black hair?

- someone with thick, short, straight, brown hair
- someone with thin, straight, long, black hair
- someone with thin, curly, short, black hair
- someone with thin, straight, short, black hair

(A) 0    (B) 1    (C) 2    (D) 3    (E) 4
2. Fractal Circles

The first three fractal circles contain 1, 4 and 13 circles.

How many circles are there in the fourth fractal circle?

(A) fewer than 30  (B) 30–34  (C) 35–39
(D) 40–44  (E) more than 44

3. Star Distances

An ant has to get from the centre of the star to one of its tips. It can only walk along the segments shown in the diagram below. Each segment has a number on it, and the ant adds up all the numbers on its path. What is the smallest sum that the ant can make on its way from the centre to one of the tips?

(A) 9  (B) 10  (C) 11  (D) 12  (E) 13
4. Security Pass

You have to go from A to B, but there are checkpoints on the way. You can bypass some checkpoints but not all of them, as you can only go from left to right.

Each checkpoint has a certain security level and only persons with a security pass of at least that level can get past it. So a security pass of 10 would get you past all checkpoints, whilst a security pass of 3 would only get you past the checkpoint with level 3. What is the lowest level of security pass needed to get from A to B?

(A) 6  (B) 7  (C) 8  (D) 9  (E) 10

5. The New Truck

A mining community consists of seven towns that are already connected by an extensive road system. However, a new truck has been ordered that requires some of the existing roads to be widened. A survey has revealed the cost of widening each section of road and the results are given on the diagram below. The council is not concerned whether the truck travels by the shortest route. It only requires that there is a way the truck will be able to travel from any one town to any other town in the community.

Further, two of the roads are flood prone and the council has decided that those two must be included in the roads to be widened. They are shown in bold.

What is the smallest total cost that the council would have to pay?

(A) 74  (B) 76  (C) 78  (D) 80  (E) 82
6. Card Shuffle

You have two tables, labelled A and B. At the start there is a line of cards on table A. Each card has on it a single digit, so that together the line of cards forms a number. Table B is empty.

You wish to move the cards to table B and make as large a number as possible. You are allowed the following moves:

- **Move X**: Take the leftmost card from table A and place it at the rightmost end of the cards on table B.
- **Move Y**: Take the rightmost card from table A and place it at the rightmost end of the cards on table B.

For example, suppose that on table A there are three cards that form the number 123. The following diagram illustrates the moves YXX, giving a final number 312 on table B.

```
<table>
<thead>
<tr>
<th>A. 1 2 3</th>
<th>y</th>
<th>A. 1 2</th>
<th>x</th>
<th>A. 2</th>
<th>x</th>
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<tr>
<td>B.</td>
<td></td>
<td>B. 3</td>
<td></td>
<td>B. 31</td>
<td></td>
</tr>
</tbody>
</table>
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If the cards on table A are 3 7 1 2 6 5 4, what is the fourth digit in the largest number you could make on table B?

(A) 3     (B) 4     (C) 5     (D) 6     (E) 7
7–9. Swampy Ground

A road has to be built over swampy ground from A to B. This will involve building five bridges. The diagrams below show the possible routes, with the thick horizontal lines showing the possible bridge sites. The number above each bridge represents its cost. For each diagram, what is the lowest possible cost of the five bridges? (The road can only go from left to right.)

7.

8.

9.
10–12. Flow Diagram

Flow diagrams provide a visual way of showing a process or algorithm. In the diagrams below, a box is used for an action, an ellipse (shaded) for making a decision, and arrows indicate the flow of control.

For example, in the flow diagram below, if A was input as 9 it would be output as 13, whilst if it was input as 11 it would be unchanged and output as 11.

For each of the following diagrams, what is the value of the output?

10. Input A = 10, B = 44
   Is B more than A? yes
   Subtract A from B
   no
   Output B

Note that if A was 2 and B was 6, then ‘Subtract A from B’ would make B equal to 4 but leave A unchanged at 2.

11. Input A = 43, B = 10, C = 0
   Is A less than B? no
   Subtract B from A, add 1 to C
   yes
   Output C
12.

Input $A = 10$, $B = 26$

Is $A$ more than $B$?

Add 1 to $B$

Is $A$ 1 more than $B$?

Output $B$

13–15. Waterholes

You are surveying the endangered desert penguins of the Simpson Desert. You have to travel from your base to an outlying camp. The numbers show the location and capacities of water holes, and the dashed lines show the trails made by the penguins. In the first two maps, the dotted lines are 1 kilometre apart. In the third map the dashed lines are 1 kilometre apart.

You need 1 litre of water per kilometre, and you can fill up at waterholes on the way, but it is too sandy to leave the penguin trails and you do not want to walk further than you must. What is the least amount of water (in litres) you need to take from the base to reach the camp?

13.

```
Base 3 3 1 3 2 5 1 Camp
```

14.

```
Base 4 2 4 4 2 1 1 3 Camp
```

15.

```
Base 2 1 1 1 5 Camp
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<td>4</td>
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