INSTRUCTIONS:

1. Please **DO NOT OPEN** the contest booklet until the Proctor has given permission to start.

2. **Duration: 1 hour and 30 minutes**

3. There are 30 questions in this paper. Each question scores 3 points in Section A, 4 points in Section B and 5 points in Section C. No points are deducted for Unanswered question. 1 point is deducted for Wrong answer.

4. Shade your answers neatly in the answer entry sheet.

5. PROCTORING: No help should be given to any student in any way during the contest.

6. **No calculators** are allowed.

7. All students must fill and shade in your **Name, Index number, Level and School** in the Answer sheet provided.

8. Students are not allowed to leave the venue within the first hour of the contest and 15 minutes before the end of the contest.

9. Students must show detailed working and transfer their answers to the answer entry sheet.

10. No spare papers can be used in writing this contest. Enough space is provided for your working of each question.

11. Students are not allowed take any answer script, reference materials and contest paper out of the venue.
Rough Working
Section A  (Correct – 3 points | Unanswered – 0 points | Wrong – deduct 1 point)

**Question 1**
In a family, each child has at least two brothers and at least one sister. What is the smallest possible number of children in the family?

(A) 3  (B) 4  (C) 5  (D) 6  (E) 7

**Question 2**
Some of the rings in the picture form a chain that includes the ring indicated by the arrow. How many rings are there in the longest possible chain?

(A) 3  (B) 4  (C) 5  (D) 6  (E) 7

**Question 3**
The lengths of the two sides of the triangle are 5 and 2, and the length of the third side is an odd number. Find the length of the third side.

(A) 3  (B) 4  (C) 5  (D) 6  (E) 7

**Question 4**
The distance from the sleeping cat on the floor to the top of the cat sitting on the table is 150 cm as shown in the picture below. The distance from the cat sitting on the floor to the cat sleeping on the table is 110 cm as shown in the picture below. What is the height of the table?

(A) 110 cm  (B) 120 cm  (C) 130 cm  (D) 140 cm  (E) 150 cm
Question 5
The sum of 5 consecutive integers is $10^{2018}$. What is the middle number?

(A) $10^{2013}$   (B) $5^{2017}$   (C) $10^{2017}$   (D) $2^{2018}$   (E) $2 \cdot 10^{2017}$

Question 6
Given three congruent hexagon, $A$, $B$ and $C$ represents the total area of the shaded region in each regular hexagon as shown in the picture picture below. Which of the following statements is true?

(A) $A = B = C$   (B) $B = C \neq A$   (C) $C = A \neq B$

(D) $A = B \neq C$   (E) $A \neq B \neq C$

Question 7
Mary has collected 42 apples, 60 apricots and 90 cherries. She wants to divide them into identical piles using all of the fruit and then give a pile to each of her friends. What is the most number of piles she can make?

(A) 3   (B) 6   (C) 10   (D) 14   (E) 42

Question 8
Some of the digits in the following correct addition have been replaced by the letters $P$, $Q$, $R$ and $S$, as shown. What is the value of $P + Q + R + S$?

\[
\begin{array}{c}
P \ 4 \ 5 \\
+ Q \ R \ S \\
\hline
6 \ 5 \ 4 \\
\end{array}
\]

(A) 14   (B) 15   (C) 16   (D) 17   (E) 24
Question 9
What is the sum of 25% of 2018 and 2018% of 25?

(A) 1009  (B) 2016  (C) 2018  (D) 3027  (E) 5045

Question 10
How many different routes are there from A to B along the lines following the directions of the arrows as shown in the picture below?

(A) 20  (B) 16  (C) 12  (D) 9  (E) 6

Section B  (Correct – 4 points | Unanswered – 0 points | Wrong – deduct 1 point)

Question 11
Two buildings are located on one street at a distance of 250 metres from each other. There are 100 students living in the first building, and there are 150 students living in the second building. Where should a bus stop be built so that the total distance that all residents of both buildings have to walk from this bus stop to their buildings would be the least possible?

(A) in front of the first building  (B) 100 metres from the first building
(C) 100 metres from the second building  (D) in front of the second building
(E) anywhere between the buildings

Question 12
There are 105 numbers written in a row: 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 5, ... (Each number n is written exactly n times). How many of these numbers are divisible by 3?

(A) 4  (B) 12  (C) 21  (D) 30  (E) 45
Question 13
Eight congruent semicircles are drawn inside a square of length 4. What is the area of the non-shaded part of the square?

(A) $2\pi$  (B) 8  (C) $6 + \pi$  (D) $3\pi - 2$  (E) $3\pi$

Question 14
On a certain day 40 trains each travelled between two of the towns $M$, $N$, $O$, $P$ and $Q$. 10 trains travelled either from $M$ or to $M$. 10 trains travelled either from $N$ or to $N$. 10 trains travelled either from $O$ or to $O$. 10 trains travelled either from $P$ or to $P$. How many trains travelled from $Q$ or to $Q$?

(A) 0  (B) 10  (C) 20  (D) 30  (E) 40

Question 15
At the University of Humanities you can study languages, history and philosophy. 35 % of students that study languages, study English. 13 % of the university students study a language other than English. No student studies more than one language. What percentage of the university students study languages?

(A) 13 %  (B) 20 %  (C) 22 %  (D) 48 %  (E) 65 %

Question 16
Peter wanted to buy a book, but he didn’t have any money. He bought it with the help of his father and his two brothers. His father gave him half of the amount given by his brothers. His elder brother gave him one third of what the others gave. The younger brother gave him 10 EUR. What was the price of the book?

(A) 24 EUR  (B) 26 EUR  (C) 28 EUR  (D) 30 EUR  (E) 32 EUR
Question 17
How many 3-digit numbers are there with the property that the 2-digit number obtained by removing
the middle digit in the number is equal to one ninth of the original 3-digit number?

(A) 1  (B) 2  (C) 3  (D) 4  (E) 5

Question 18
In the calculation shown, how many times does the term $2018^2$ appear inside the square root to make
the calculation correct?

$$\sqrt{2018^2 + 2018^2 + \ldots + 2018^2} = 2018^{10}$$

(A) 5  (B) 8  (C) 18  (D) $2018^8$  (E) $2018^{18}$

Question 19
$$\frac{1}{7} \times 10^{2018} \times (10^{2018} - 1) = x.$$ How many digits are there in the value of $x$?

(A) 2017  (B) 2018  (C) 4035  (D) 4036  (E) 4037

Question 20
There are two diagonals drawn in a regular polygon with 2018 sides and its vertices are numbered
from 1 to 2018. One diagonal connects the vertices with the numbers 18 and 1018, the other connects
the vertices with the numbers 1018 and 2000. How many vertices do the resulting three polygons
have?

(A) 38, 983, 1001  (B) 37, 983, 1001  (C) 38, 982, 1001  (D) 37, 982, 1000  (E) 37, 983, 1002
**Section C** (Correct – 5 points | Unanswered – 0 points | Wrong – deduct 1 point)

**Question 21**
Several integers are written on a blackboard, including the number 2018. The sum of all these integers is 2018. The product of these integers is also 2018. Which of the following could be the number of integers written on the blackboard?

(A) 2016  (B) 2017  (C) 2018  (D) 2019  (E) 2020

**Question 22**
Four positive numbers are given. You choose three of them, calculate their arithmetic mean and then add the fourth number. This can be done in four different ways. The results are 17, 21, 23 and 29 respectively. What is the largest of the given four numbers?

(A) 12  (B) 15  (C) 21  (D) 24  (E) 29

**Question 23**
The points $A_0$, $A_1$, $A_2$, ... lie on a line such that $A_0A_1 = 1$ and the point $A_n$ is the midpoint of the segment $A_{n+1}A_{n+2}$ for every non-negative integer $n$. What is the length of the segment $A_0A_{11}$?

(A) 171  (B) 341  (C) 512  (D) 587  (E) 683

**Question 24**
Two concentric circles of radii 1 and 9 make a ring. In the interior of this ring $n$ circles are drawn without overlapping, each being tangent to both of the circles of the ring (an example of such shape for $n = 1$ and different radii is shown in the picture). What is the largest possible value for $n$?

(A) 1  (B) 2  (C) 3  (D) 4  (E) 5
Question 25
A regular polygon with 18 vertices where each number written on the vertices is equal to the sum of the numbers at the two adjacent vertices. Two of the numbers are given. What number should be written at the vertex A?

\[ \begin{array}{c}
20 \\
18
\end{array} \]

(A) 2018  (B) -20  (C) 18  (D) 38  (E) -38

Question 26
Diana draws a rectangular grid of 12 squares. Some of the squares are painted black. In each blank square she writes the number of black squares that shares a side with it. The figure shows an example. Now she does the same in a rectangular grid with 2018 squares. What is the maximum value that she can obtain as the result of the sum of all the numbers in the grid?

\[
\begin{array}{ccc}
1 & \color{black}{2} & 1 \\
0 & 3 & \color{black}{2} \\
1 & \color{black}{2} & 1
\end{array}
\]

(A) 1262  (B) 2016  (C) 2018  (D) 3025  (E) 3027

Question 27
Seven small cubes have been removed from a $3 \times 3 \times 3$ cube (see the picture). We cut this cube by the plane passing through the centre of the cube and perpendicular to one of its four big diagonals. What will the cross-section look like?

(A)  
\[
\begin{array}{c}
\astar
\end{array}
\]

(B)  
\[
\begin{array}{c}
\astar
\end{array}
\]

(C)  
\[
\begin{array}{c}
\astar
\end{array}
\]

(D)  
\[
\begin{array}{c}
\astar
\end{array}
\]

(E)  
\[
\begin{array}{c}
\astar
\end{array}
\]


Question 28
Each number of the set \{1, 2, 3, 4, 5, 6\} is written exactly into one of the square in a 2×3 table. In how many ways can this be done such that in each row and in each column the sum of the numbers is divisible by 3?

(A) 36  (B) 42  (C) 45  (D) 48  (E) another number

Question 29
Ed made a large cube by gluing together a number of small identical cubes and then he painted some of the faces of the large cube. His sister Nicole dropped the cube and it broke into the original small cubes. 45 of these small cubes didn’t have any painted faces. How many faces of the large cube did Ed paint?

(A) 2  (B) 3  (C) 4  (D) 5  (E) 6

Question 30
Two chords \(AB\) and \(AC\) are drawn in a circle with diameter \(AD\). The angle \(\angle BAC = 60^\circ\), \(BE \perp AC\), \(AB = 24\ \text{cm},\ \EC = 3\ \text{cm}\). What is the length of the chord \(BD\)?

(A) \(\sqrt{3}\) cm  (B) 2 cm  (C) 3 cm  (D) 2\sqrt{3} \text{ cm}  (E) 3\sqrt{2} \text{ cm}
Rough Working
Rough Working