International Mathematics and Science Olympiad (IMSO) for Primary School 2006

Jakarta, November 12-18, 2006

Instructions:

* Write down your name and country on the answer sheet.

* Write your answer on the answer sheet.

* Answer all 25 questions in English.

* You have 60 minutes to work on this test.

* Use pen to write your answer.

1. Three signal lights were set to flash every certain specified time. The first light flashes every 12 seconds, the second flashes every 30 seconds and the third one every 66 seconds. The signal lights flash simultaneously at 8:30 a.m. At what time will the signal lights next flash together?

2. Dina's money consists of ten-thousand and five-thousand rupiah bills. The number of ten-thousand bills is three more than twice the number of five-thousand bills. If Dina has $Rp355,000,$ what is the number of ten-thousand bills that she has?

3. The principal of Makmur Jaya Elementary School is replaced every 4 years. At most how many principals will the school have from 2006 to 2020?

4. The area of the shaded region shown in the figure below is $98cm^2$. Find the length of a.
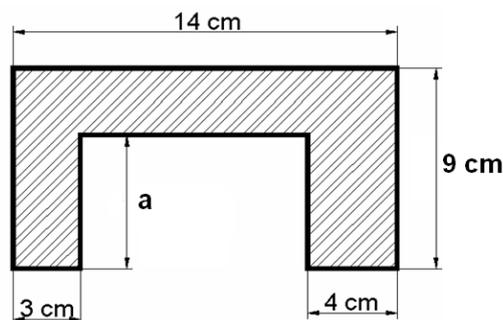
5. The sequence below is arranged by using numbers $1, 2$ and 3 only:
$$1, 2, 2, 3, 3, 3, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 1, 1, 1, 1, 1, 1, 1, \ldots$$
What is the 100th number?

6. Every whole number larger than 7 can always be expressed as a sum of 3's, 5's, or both. For example, $9 = 3 + 3 + 3$, $10 = 5 + 5$ and $19 = 5 + 5 + 3 + 3 + 3$. With the rule that 5 always comes before 3, how many ways can we express 444?

7. Consider all possible numbers between 100 and 2006 which are formed by using only the digits $0, 1, 2, 3, 4$ with no digit repeated. How many of these are divisible by 6?

8. Two runners run in opposite directions from the same starting line. They run around a field which has 300 m perimeter. If the first runner runs at 150 m/minute and the second one runs at 125 m/minute, how many times will the two runners pass each other in the first 20 minutes?

9. The ratio of the number of students in Class A to Class B is 1:2. The ratio of the respective average test scores is 8:9. If the average score of class A is 72, find the average score of all the students.

10. In the following figures, the area of the biggest equilateral triangle is $16cm^2$. A new triangle is formed by connecting the midpoints of the sides of the previous triangle. If the pattern continues, find the area of the smallest triangle in Figure 5.
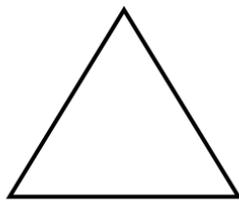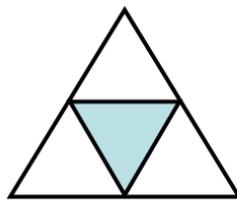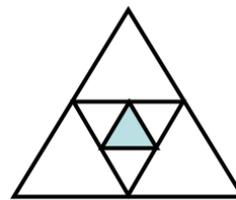
Figure 1   **Figure 2**   **Figure 3**

11. Each vertex of a regular pentagon is connected to the other vertices as shown in the figure below so that the pentagon is divided into 11 non-overlapping regions. How many non-overlapping regions can be obtained if we do the same procedure to a regular hexagon?
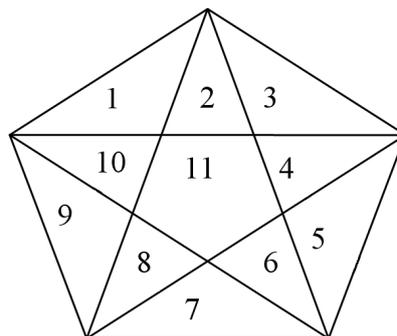
12. A 20cm × 40cm × 80cm wooden block is sliced into four small identical blocks. Find the largest possible sum of the surface areas of the small blocks.

13. The perimeters of a square and an equilateral triangle are equal. If the length of the side of the equilateral triangle is 8 cm, find the area of the square.

14. The faces of a cube are to be painted so that two faces with a common edge are painted with different colours. Find the minimum number of colours needed to do this.

15. How many non-congruent triangles with perimeter 11 have integer side lengths?

16. The following magic square is to be filled with numbers $17, 18, ..., 24$ so that the sums of numbers in every column, every row and the two diagonals are equal.
    Which number should be in the cell with the star $(*)$?

25		$(*)$

17. The faces of a dice are marked with dots from 1 to 6. The total number of dots on two opposite faces (top-bottom, left-right, front-back) is 7. Four dices are arranged as shown below. The faces of two dices that touch each other have the same number of dots. What is the total number of dots on the faces that touch each other?
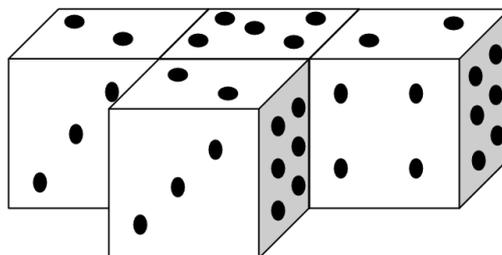
18. Every edge of a cube is colored either red or green. In order to have at least one red edge on every face of the cube, find the minimum number of edges that must be colored red.

19. Let A, B, C represent three different digits such that:

$$
\begin{array}{r}
\mathbf{AB} \\
\mathbf{BA} \\
\mathbf{AC} \\
\mathbf{CA} \\
\mathbf{BC} \\
+\ \mathbf{CB} \\
\hline
\mathbf{ABC}
\end{array}
$$

Find the largest possible value of the 3-digit number ABC.

20. When 31513 and 34369 are each divided by a certain 3-digit number, the remainders are equal. Find this remainder.

21. What is the volume of the concrete foot bridge shown below?
(Use $\pi = \frac{22}{7}$)

Radius 4m

7m   3m
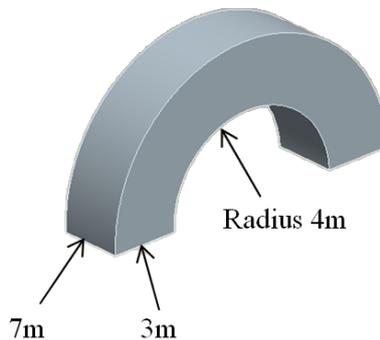
22. The sides of a trapezoid touch the circle of radius 10 as shown in the figure below. The non parallel sides are of lengths 23 and 27 cm respectively. Find the area of trapezoid.
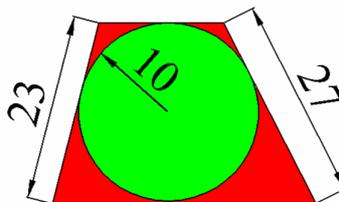
23. Each of the letters A, D, E, K, S, W and Y represents a different one of the digits $0, 1, 2, 3, 4, 5, 6, 7$ and 8 such that

<div align="center">

DAYS
x   **7**
───────
WEEK

</div>

Which digit does E represent?

24. Dogol writes a sequence of five non-negative 1-digit numbers on the blackboard. He then erases two consecutive numbers and replaces them with their difference. He obtains the sequence $5, 0, 3, 5$ on the board.

How many possible sequences can he start with?

25. If you read the picture on the left below, it says there are 3 ones, 1 two and 1 four, which is correct. Fill in the four boxes in the picture on the right to make it correct too. Write down the four digits from left to right as a 4-digit number.