Indonesia International Mathematics Competition 2021 (Virtual)

Indonesia, 27th July to 1st August 2021

Elementary Mathematics International Contest

Team Contest

Time limit: 70 minutes

Information:

- You are allowed 70 minutes for this paper, consisting of 10 questions printed on separate sheets. For questions 1, 3, 5, 7 and 9, only numerical answers are required. For questions 2, 4, 6, 8 and 10, full solutions are required.
- Each question is worth 40 points. For odd-numbered questions, no partial credits are given. There are no penalties for incorrect answers, but you must not give more than the number of answers being asked for. For questions asking for several answers, full credit will only be given if all correct answers are found. For even-numbered questions, partial credits may be awarded.
- Diagrams shown may not be drawn to scale.

Instructions:

- Write down your team's name in the space provided on every question sheet.
- Enter your answers in the space provided after the individual questions on the question paper.
- During the first 10 minutes, the four team members examine the first 8 questions together, and altogether discuss them. Then they distribute the questions among themselves, with each team member is allotted at least 1 question.
- During the next 35 minutes, the four team members write down the solutions of their allotted problems on the respective question sheets, with no further communication / discussion among themselves.
- During the last 25 minutes, the four team members work together to write down the solutions of the last 2 questions on the respective questions sheets.
- It is forbidden to use instruments such as protractors, calculators and electronic devices.
- At the end of the contest, you must hand in the envelope containing all question sheets and all scratch papers.

English Version

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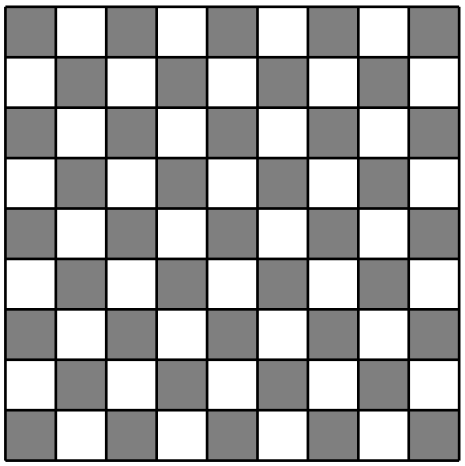
TEAM CONTEST

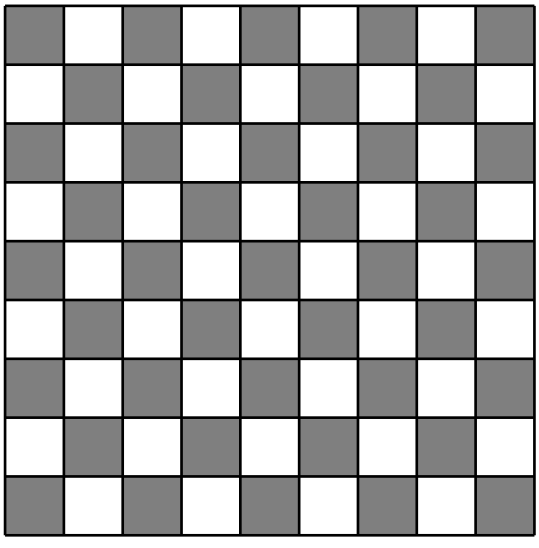
29th July, 2021, Indonesia

Team : _____ Solver : _____ ID : _____

1. In the diagram below, a 9×9 chessboard is shown where each unit square is alternately coloured in black or white and each of its four corners are all coloured in black. Now, a lame bishop starts on any black square. If in each move, it can go to any diagonally adjacent black square without visiting any white squares, what is the minimum number of moves required to be able to visit all the black squares, not necessarily returning to its starting square? Draw the path.



Answer: _____ moves,



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2. A 1×2021 plank is to be cut into 2021 unit squares. In each move, we can either cut through a single plank, dividing it into two (not necessarily equal), or through a stack of planks of equal length, dividing each of them into two in the same way. Your task is to achieve this goal using as few cuts as you can. How many cuts do you need? Describe your process in full detail.

Answer: _____ cuts

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3. How many positive integers from 1 to 2021 included are divisible by either 2 or 5 but not by any other prime numbers?

Answer: _____ positive integers

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4. The first few positive integers starting from "1" were written on a board. If one of the numbers was erased, then the average of the remaining numbers becomes $\frac{45}{4}$. Which number was erased?

Answer: _____

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5. A thin plastic triangle that is lying on a flat surface may be flipped over any of its edges repeatedly. Whenever its new position shares an interior point with its initial position after several flips, the two triangles must coincide perfectly.
If triangles with equal angles are viewed as the same triangle, find the angles of all possible triangles with this property.
(Note : The number of correct answers minus the number of incorrect answers is the net correct answer, 3 marks for each net correct answer. Finding all correct answers without any incorrect answer gives 40 marks.)

Answer: (, ,), (, ,), (, ,),
(, ,), (, ,), (, ,),
(, ,), (, ,), (, ,),
(, ,), (, ,), (, ,),
(, ,), (, ,), (, ,).

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6. A cube, with side length 6 cm, is to be dissected into 49 smaller cubes. If the size of the smaller cubes does not need to be all the same but the side length, in cm, of each smaller cube must all be integers, then how many types of cubes of different sizes do we have? What is the number of cubes of each type?

There are ____ types of cubes. They are:
__ cubes with side length 1 cm, __ cubes with side length 2 cm,
__ cubes with side length 3 cm, __ cubes with side length 4 cm,
__ cubes with side length 5 cm.
The cutting way is:

Answer: _____

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7. Satya has some number of apples and oranges. It is known that the total number of those fruits that he has initially is between 100 to 300 and the ratio between the number of apples to the number of oranges is 7 : 4. Then, each day, he randomly eats two of them, but not necessarily of the same kind. On the 10th day, after he eats two of them, the ratio becomes 8 : 5. How many apples and oranges in total does Satya initially have?

Answer: Satya initially has _____ apples and oranges in total

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8. How many ten-digit positive integer multiples of 11111 do not contain two identical digits?

Answer: _____ ten-digit numbers

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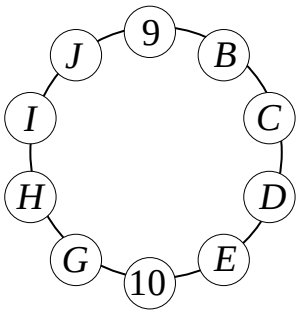
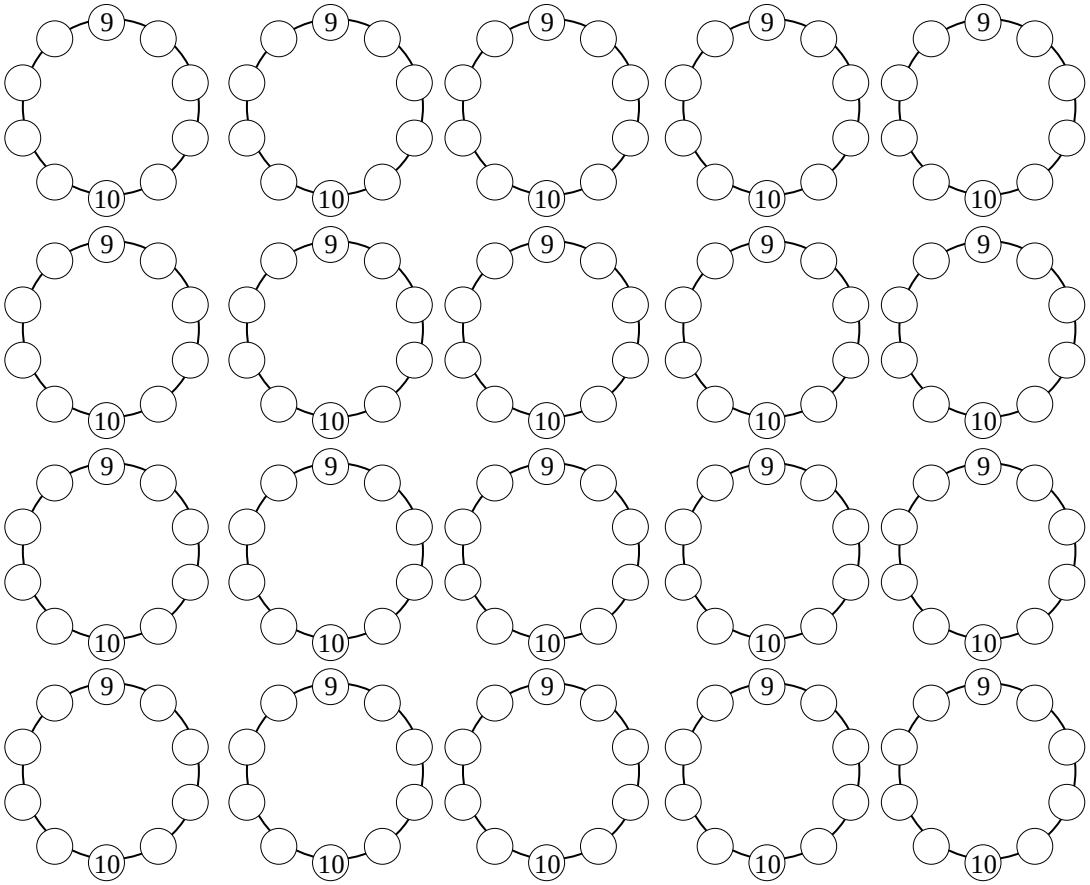
9. In the diagram below, ten beads labelled as *A*, *B*, *C*, *D*, *E*, *F*, *G*, *H*, *I* and *J* are arranged in clockwise order on a circle, where bead *A* is labelled 9 and bead *F* is labelled 10. The remaining eight beads are to be labelled with the numbers 1, 2, 3, 4, 5, 6, 7 and 8, using each number exactly once. If the number on *G* must be greater than the number on *E* and the sum of the numbers of any two adjacent beads must be a prime number, list down all different possible labellings.
(Note : The number of correct answers minus the number of incorrect answers is the net correct answer, 2 marks for each net correct answer. Finding all correct answers without any incorrect answer gives 40 marks.)



Answer: _____



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10. The road between Town M and Town S is 15 km long. Anna and Boris both leave Town M at noon, where Anna walks and Boris is riding a bike. Meanwhile, their friend Olga walks starting from Town S to Town M and all three of them are travelling on the same road. When Boris meets Olga, he gives Olga the bike and walks the rest of the way, while Olga travelled by bike until she meets Anna and gives Anna the bike. Anna then bikes the rest of the way, arriving in Town S at the same time as Boris. If the walking speed of each person is 6 km/h and their biking speed is 15 km/h, how many hours before noon did Olga leave Town S?

Answer: _____ hours before noon