**Asia Inter-Cities Teenager's Mathematics Olympiad**
Bogor, West Java, **INDONESIA**

# Team Contest

Time limit: 60 minutes    2013/12/28

## Instructions:

- Do not turn to the first page until you are told to do so.
- Remember to write down your team name in the space indicated on every page.
- There are 10 problems in the Team Contest, arranged in increasing order of difficulty. Each question is printed on a separate sheet of paper. Each problem is worth 40 points and complete solutions of problem 2, 4, 6, 8 and 10 are required for full credits. Partial credits may be awarded. In case the spaces provided in each problem are not enough, you may continue your work at the back page of the paper. Only answers are required for problem number 1, 3, 5, 7 and 9.

  The four team members are allowed 10 minutes to discuss and distribute the first 8 problems among themselves. Each student must attempt at least one problem. Each will then have 35 minutes to write the solutions of their allotted problem independently with no further discussion or exchange of problems. The four team members are allowed 15 minutes to solve the last 2 problems together.
- Diagrams are NOT drawn to scale. They are intended only as aids.
- No calculator or calculating device or electronic devices are allowed.
- Answer must be in pencil or in blue or black ball point pen.
- All papers shall be collected at the end of this test.

*Team Name* : ______________________________

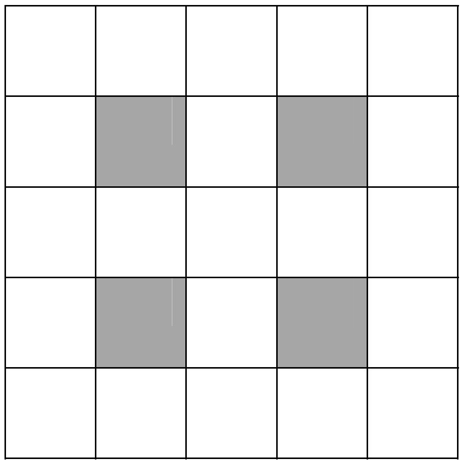
----- Jury use only ---

| Problem 1 Score | Problem 2 Score | Problem 3 Score | Problem 4 Score | Problem 5 Score | Total Score |
|---|---|---|---|---|---|
| | | | | | |
| Problem 6 Score | Problem 7 Score | Problem 8 Score | Problem 9 Score | Problem 10 Score | |
| | | | | | |

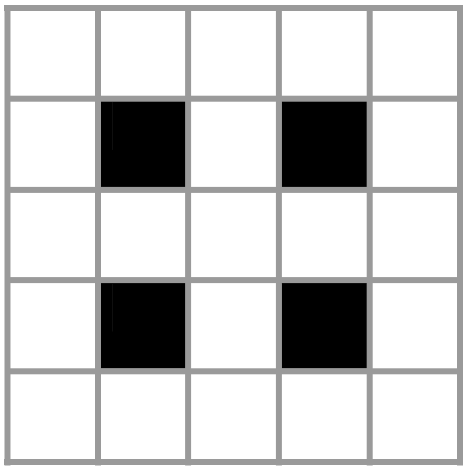
# TEAM CONTEST

*Team* : ______________________ *Score* : ______________

1. The diagram below shows a piece of 5×5 paper with four holes. Show how to cut it into rectangles, with as few of them being unit squares as possible.



***ANSWER:***



# TEAM CONTEST

*Team* : ____________________ *Score* : ____________

2. Let $p=6-\sqrt{35}$ and $q=6+\sqrt{35}$. Define $M_n = p^n + q^n$. Determine the last two digits of $M_0 + M_1 + M_2 + ... + M_{2013}$.

***ANSWER:*** ______________________

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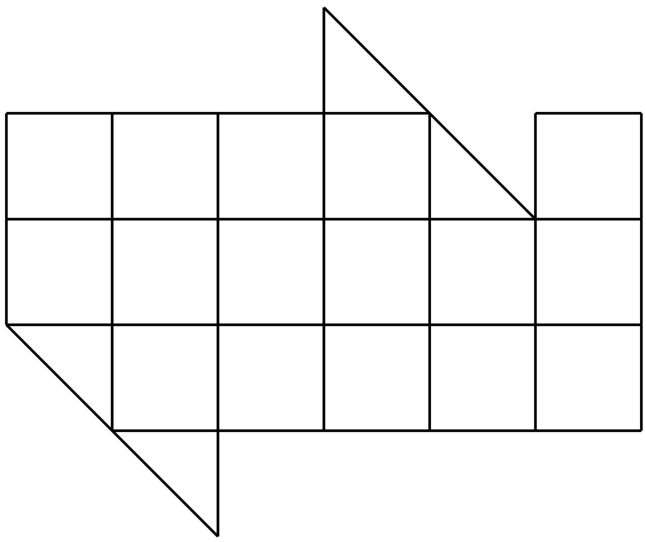
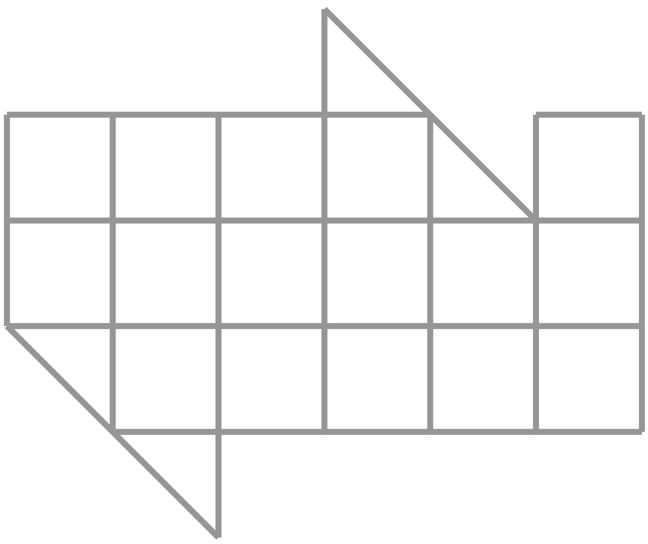
*Team* : ______________________ *Score* : ____________

3. Dissect the figure in the diagram below into two congruent pieces, which may be rotated or reflected.





***ANSWER:*** ______________________

# TEAM CONTEST

*Team* : ____________________ *Score* : ____________

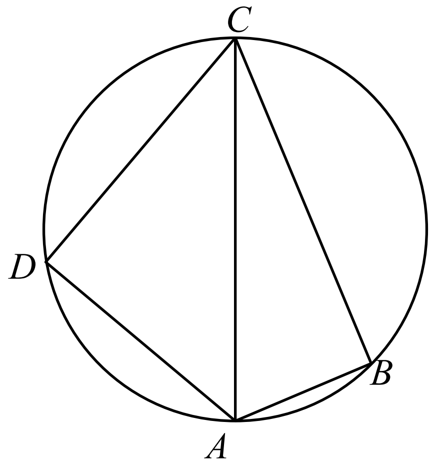
4. If $x^2 - yz - zw - wy = 116$, $y^2 - zw - wx - xz = 117$, $z^2 - wx - xy - yw = 130$ and $w^2 - xy - yz - zx = 134$, find the value of $x^2 + y^2 + z^2 + w^2$.

***ANSWER:*** ____________________

# TEAM CONTEST

*Team* : ______________________ *Score* : ______________

5. $ABCD$ is a cyclic quadrilateral with diameter $AC$. The lengths of $AB$, $BC$, $CD$ and $AC$ are positive integers in cm. If the length of $DA$ is $\sqrt{99}$ cm, find the maximum value of $AB + BC + CD$, in cm.




***ANSWER:*** ______________________ cm

# TEAM CONTEST

*Team* : ______________________ *Score* : ______________

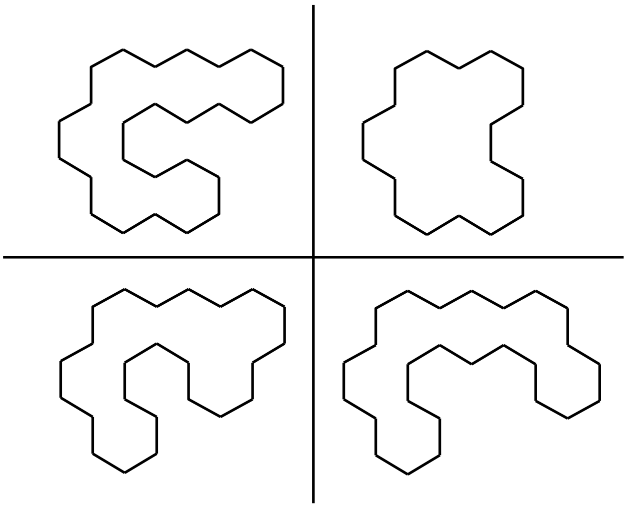
6. A bag contains one coin labeled 1, two coins labeled 2, three coins labeled 3, and so on. Finally, there are forty-nine coins labeled 49 and 50 coins labeled 50. Coins are drawn at random from the bag. At least how many coins must be drawn in order to ensure that at least 12 coins of same kind have been picked up?

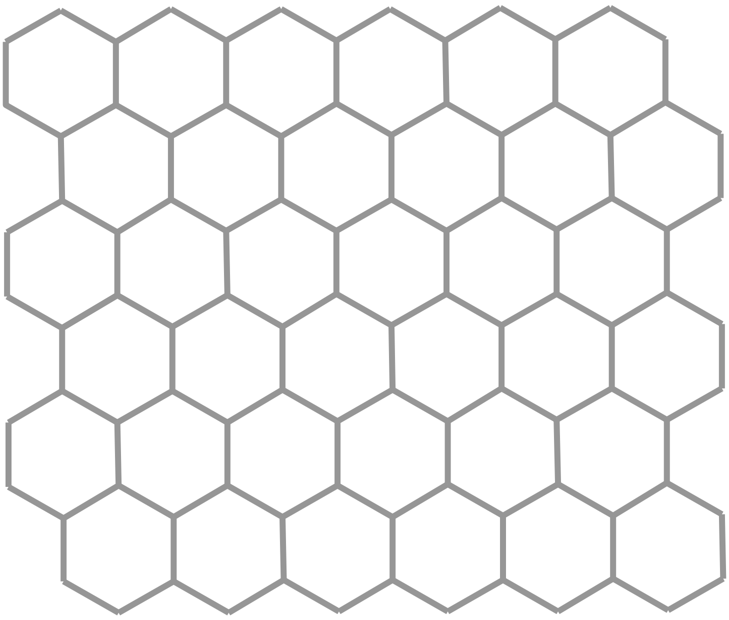
***ANSWER:*** ______________________ coins

# TEAM CONTEST

*Team* : ______________________ *Score* : ____________

7. Ordinary 2×2 magic squares do not exist unless the same number is used in all four cells. However, it may be possible in geometric magic squares, though none has yet been found. The diagram below shows an almost magic square. Find a magic constant which can be formed by the two pieces without overlapped in each row, each column and one of the two diagonals. Rotations and reflections of the pieces are allowed.



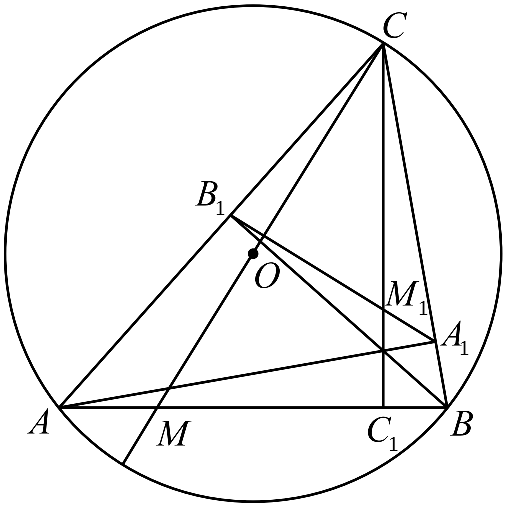


***ANSWER:*** ______________________

# TEAM CONTEST

*Team* : ______________________ *Score* : ______________

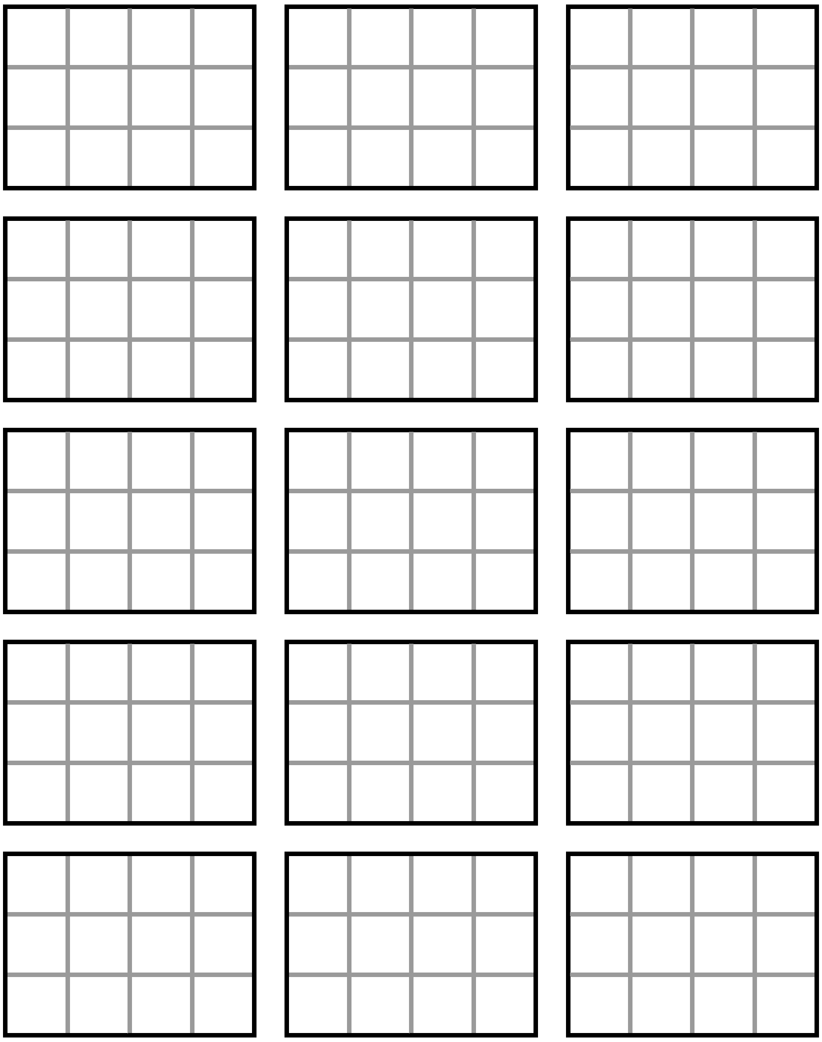
8. $AA_1$, $BB_1$ and $CC_1$ are the altitudes and point $O$ is the circumcentre (the centre of the circumscribed circle) of $\triangle ABC$. $M$ and $M_1$ are the points of intersections of $CO$ and $AB$, and of $CC_1$ and $A_1B_1$, respectively.
Prove that $MA \times M_1B_1 = MB \times M_1A_1$.



# TEAM CONTEST

*Team* : ______________________ *Score* : ______________

9. Determine all possible ways of cutting a $3 \times 4$ piece of paper into two figures each consisting of 6 of the 12 squares. The figures must be connected. They may be the same or different.



***ANSWER:*** ______________________

# TEAM CONTEST

*Team* : ____________________ *Score* : ______________

10. A building has six floors and two elevators which always moving up and down independently. A person on the floor just below the top floor is waiting for an elevator. What is the probability that the first elevator to arrive is coming from above?

***ANSWER:*** ______________________________