



Louisiana Mu Alpha Theta

affiliated with
Mu Alpha Theta
National High School and Junior College
Honorary Mathematics Club

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Open - Puzzlements

TEST RULES

1. Do not begin test until you are told to do so.
2. You must supply your own #2 pencil.
3. Only ACT approved calculators are allowed on all tests.
4. Print your name and school in the name blank, your code in the date blank, and the area test in the subject blank on your Scantron answer sheet
5. Standard procedure for machine graded papers must be followed. Use only a #2 pencil, marking the appropriate spaces carefully.
6. In case of a tie, winners will be determined according to the order in which the answer sheet was turned into the moderator.
7. Do all scratch work on your test.

Puzzlements

Included on the last page is an answer sheet to turn in that has all of the necessary charts, tables, and answer blanks into which the test-taker should fill their answer.

1. Agatha and Bethany are playing a tic-tac-toe variant on a four by four board in which they each take turns placing *both* an X *and* an O in two horizontally or vertically adjacent cells of their choice. If either player completes 3 Xs in a row (horizontally, vertically, or diagonally), Agatha wins. If either player completes 3 Os in a row, Bethany wins. If a row of 3 Xs and a row of 3 Os are completed simultaneously, the player completing both is the winner. What should Agatha's opening move be such that she will always win, given that both players are using optimal strategies?
2. In the puzzle on the answer sheet, fill in each box with a digit from 1 to 5 such that each row, column, and chain (where a chain is a set of 5 boxes connected by a line) contains the numbers 1, 2, 3, 4, and 5 once and only once.
3. Fill in the table on the answer sheet with the digits 1-9, using each once and only once, such that the horizontal rows, vertical columns, and two diagonals each sum to 15.
4. Alice and Bob are playing a three by three game of tic-tac-toe with standard rules, except that the board is mapped onto a torus (a donut shape). If Alice makes the first move, which of the following statements are true?
 - I. Alice will always win.
 - II. Bob will always win.
 - III. Alice will always win if she plays perfectly.
 - IV. Bob will always win if he plays perfectly.
 - V. Alice will win if both players play perfectly.
 - VI. Bob will win if both players play perfectly.
 - VII. Alice can win.
 - VIII. Bob can win.
 - IX. The game will always result in a draw if both players play perfectly.
 - X. The game can result in a draw.
5. A traveler finds himself on an island filled with two different races. Each race is indistinguishable from the other. The traveler quickly recalls from his studies that he has come across the fabled island that houses Knights and Knaves. On this island, Knights may only speak statements which are true, while Knaves may only tell lies. As the intrigued traveler proceeds with his studies of these remarkable races, he soon realizes that he has forgotten which day it is. He comes across a group of four natives and proceeds to ask them one by one.

The first answers, "Yesterday was Wednesday."
The second answers, "Tomorrow will be Sunday."
The third answers, "Today is Friday."
The fourth answers, "The day before yesterday was Thursday." (continued on next page)

The traveler is perplexed and cannot decide what to believe. Can the traveler definitely tell from this information which day it is, and if so, which is it?

6. A game is played with four dice. A different letter of the alphabet appears on each face of each of the four dice so that 24 of the 26 letters of the alphabet occur. Words are formed by rearranging and turning the dice so that the upward-facing letters spell a four-letter word. The 13 words below have been anagrammed using today's cubes, which do not have a Q or Z on them. What were 6 letters on each die?

BILE	DOGY	LEFT	VOID
CAGE	FORT	MEWS	
CRUX	HANK	MULE	
DINE	LEFT	SLAP	

7. A teacher says: I'm thinking of two whole numbers greater than 1. The teacher tells Patrick their product and Samantha their sum.
- Patrick: I do not know the sum.
- Samantha: I knew that. The sum is less than 14.
- Patrick: I knew that. However, now I know the numbers.
- Samantha: And so do I.

What were the two numbers?

8. Given the following clues, construct a pyramid of ten numbers such that the top row contains one number, the second contains two, the third contains three, and the fourth contains four that satisfies that following conditions:
- The leftmost number in the bottom row subtracted from the topmost number in the pyramid is 6.
 - The sum of the topmost number and the leftmost numbers of the second through fourth rows is 21.
 - The numbers making up the third row of the pyramid sum to 14.
 - The rightmost number in the bottom row minus the sum of the two numbers in the second row is 1.
 - The sum of the topmost number and the rightmost numbers of the second through fourth rows equals 25.
 - In the bottom row, the second number from the right is 2.