Mu Alpha Theta National Convention: Denver, 2001
## Colorado Mix

Station 1

1. What is the outcome when the sum of the digits of a positive two-digit integer is subtracted from the integer and the result is divided by 9?

2. What number added separately to 100, 220 and 340, will make the three results the squares of three integers?

3. What number added separately to 200, 208 and 216, will make the three results the cubes of three integers?

4. Place the integers 11-20 in the blank squares in the figure below in such a way that the distance between consecutive integers is increasing (i.e. 11-12 would be the closest consecutive numbers, and 19-20 would be the farthest consecutive numbers). Distances should be measured between the centers of the squares.
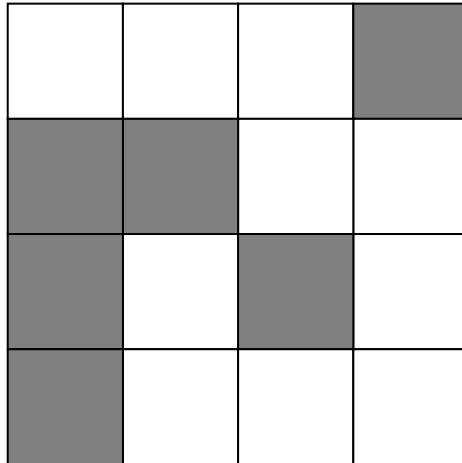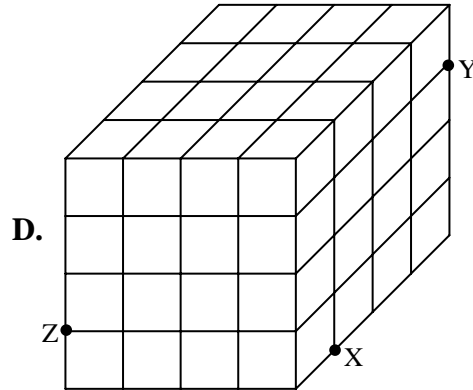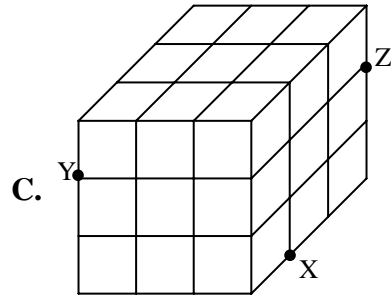
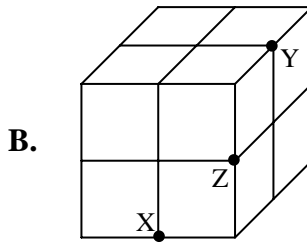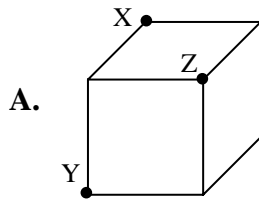# Station 2

1. Explain how to construct four equilateral triangles of side length one using six line segments of unit length.

2. Without lifting your pencil, draw four line segments that will pass through the centers of all nine points on the figure at the right.

   •   •   •

   •   •   •

   •   •   •
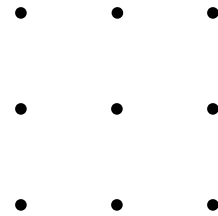
3. Rubic's Geometry: Determine the measure of angle XZY in each of A-D.

A.

B.

C.

D.

Station 3

CHOMP!: You will play a game against one of the proctors running the CHOMP! station. In this game, 12 "crackers" are laid out in a 3 by 4 grid as shown below. You and your opponent will take turns selecting a cracker to take on each turn, but when you take a cracker, you must also take every cracker to the right or below the cracker you chose. Note that the upper left cracker is poisoned… each player MUST take a cracker on their turn, and whoever gets the poison cracker loses, making the other player the winner. You must beat your opponent to get credit for this station.
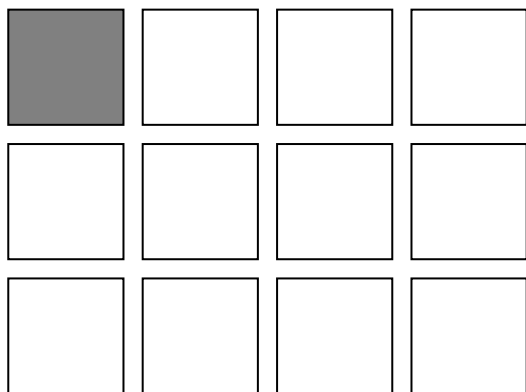
Station 4

1. In the game of matches, players take turns removing matches from a pile until one of them is forced to remove the final match. Whoever removes the final match is the loser, the other player is the winner. There are two variations of this game: in one, each player must remove either one, two, or three matches on each turn; in the other, each player must remove a square number of matches on each turn. For each of these two variations, you are to play a game against an opponent in which the initial number of matches is 142. For each game, you can choose whether you or your opponent takes the first turn. You can assure victory in both games… who should go first in each game (you or your opponent), and how many total turns will each game consist of (including the turn in which the loser must pick the final match) if your primary goal is to guarantee victory, your secondary goal is to minimize the maximum game length, and your opponent's goal is to maximize the minimum game length?

2. Lori is building a card house from four decks of cards (208 cards), according to some very strict rules. Each level of her card house must contain a square number of cards, and each level must contain more cards than the level above it. Furthermore, she must use all 208 cards.

    A. How many cards are in each level of the shortest (fewest layers) house Lori can build?
    List all possible solutions in order from the top level to the bottom.
    B. How many cards are in each level of the tallest (most layers) house Lori can build?
    List all possible solutions in order from the top level to the bottom.

Station 5

1. Approximately how much is the human population of the Earth increasing each minute?
    - A. 1-100
    - B. 101-200
    - C. 201-300
    - D. 301-400
    - E. More than 400

2. The Earth orbits the sun. How long does one complete revolution of the Earth around the sun take?
    - A. less than 365¼ days
    - B. exactly 365¼ days
    - C. more than 365¼ days

3. The Earth not only revolves around the sun, but also rotates on its axis. How long does one complete rotation of the Earth around its axis take?
    - A. less than 24 hours
    - B. exactly 24 hours
    - C. more than 24 hours

4. Imagine you are in the land of Knights, Knaves, and Normals, with three types of inhabitants which behave very differently: Knights always tell the truth, Knaves always lie, and Normals sometimes tell the truth and sometimes lie. Assume you meet one of these inhabitants, and he tells you: "I'm no Knight". What type of inhabitant is he?

    - A. Knight
    - B. Knave
    - C. Normal
    - D. Cannot be determined

5. In the land of Knights, Knaves, and Normals, a man and a woman may only marry if they are both Normal, or if one of them is a Knight and the other one is a Knave. If you meet Mr. and Mrs. A, who tell you the following   Mr. A: "My wife is not normal"
                                                            Mrs. A: "My husband is not normal",
    what types of persons are Mr. and Mrs. A?

    - A. They are both Normal.
    - B. Mr. A is a Knight and Mrs. A is a Knave.
    - C. Mr. A is a Knave and Mrs. A is a Knight.
    - D. Cannot be determined.

6. One day Alice meets the Lion and the Unicorn in the Forest of Forgetfulness. She knows that the Lion lies on Mondays, Tuesdays, and Wednesdays, and tells the truth on the other days of the week. The Unicorn, on the other hand, lies on Thursdays, Fridays, and Saturdays, but tells the truth on the other days of the week. They make the following statements to Alice:

   Lion: Yesterday was one of my lying days.
   Unicorn: Yesterday was one of _my_ lying days.

   What day is it?

   A. Sunday
   B. Monday
   C. Tuesday
   D. Wednesday
   E. Thursday
   F. Friday
   G. Saturday

7. Consider two jars, the first containing a liter of wine and the second containing a liter of water. Suppose you take one cup of wine out of the first jar and pour it into the second jar. After mixing you take one cup of the mixture from the second jar and pour it back into the first jar. Which one of the following statements holds now?

   A. There is more water in the first jar than wine in the second jar.
   B. There is less water in the first jar than wine in the second jar.
   C. There is as much water in the first jar as there is wine in the second jar.
   D. None of the previous statements holds.

8. In Federal Way the following facts are true:
   No two inhabitants have exactly the same number of gray hairs.
   No inhabitant has exactly 85124 gray hairs.
   There are more inhabitants than there are gray hairs on the head of any one inhabitant.

   What is the largest possible number of inhabitants of Federal Way?

   A. 0
   B. 85122
   C. 85123
   D. 85124

Station 6

Brian has four calculators, three of which always give the right answer, but one of which sometimes gives wrong answers. His four calculators are the CalcPro75, the Mathmagic+, the Summinator5000, and the SupersignII. Each of the calculators is a different color, either red, white, blue, or black. The prices of the four calculators are all a different whole number of dollars. The most expensive calculator works fine, and is either blue or red. The second most expensive calculator is the Mathmagic+, which costs $12. The SupersignII is two dollars less expensive than the Summinator5000 and two dollars more expensive than a properly working calculator that is either black or white. The blue calculator is two dollars less expensive than another calculator. The white calculator is more expensive than the calculator that doesn't work.

Fill in the following chart with the correct information:

Name	Works? (Y/N)	Color	Price
CalcPro75			
Mathmagic+			
Summinator5000			
SupersignII			

Station 7

Let $A = 12341234 \times 13131313$,
         $B = 12121212 \times 12311231$,
         $C = 11111111 \times 10101010$,
         $D = 12345678 \times 10111011$.
Evaluate $A + B + C + D$.

Station 8

1. Unscramble the following mathematical anagrams:
    - A. aimox
    - B. aabeglr
    - C. diiinosv
    - D. abehlopry
    - E. cceeegnnorv
    - F. abbiiloprty
    - G. aegiinnortt
    - H. aacehimmtts

2. List at least thirty words consisting of more than three letters each that can be made from the letters in the word ARITHMETIC. Judges will be examining these lists quickly, so it may be to your advantage to avoid obscure or questionable words with which they may not be familiar.

This is a bunch of generic text so that youw can have some sort of pattern to use as you reassemble the puzhzle. Alas, it means I have to come up with sometahing interesting to say. Or, failing thtat, at least something that is recognizable as senteinces, so that you can use your knowledge of English, in addition to the shsapes of the letters, to help you re-assemble this. Oth, good, it looks like I'm near the end of the first page, which means I'hm halfeway done. My goasl is to have the

puage printed front and back, so that it's a bit mmore confusoing to figure out which side is which when assefmbling the puszzle. The answer to this puzzle will be the answeer to a math quvestion that is teo be fonund in the "extra" letters that occur thraoughout this fanirly borindg text. They should spell eoiut a sentengce asking a very bahsic math question. When you get the answter to that question, turn it in at Station 2. Enjoy!