Student Name: _____

Welcome to the Third Annual Harrison Chen Memorial Math Competition!

Please observe the following information for the competition.

- <u>Scoring</u>. All problems will be worth one point. This means that the most difficult problems will be worth the same as the more straightforward problems. Your goal is to get as many correct as you can within the 60 minutes allowed.
- <u>Answer Key</u>. You **MUST** write the answer in the answer key provided. If you do not, no credit will be given, so make sure you write down your answer in the key as soon as you finish a problem!
- <u>Work</u>. You **MUST** show work in order to receive credit for a problem. Do not solve problems in your head! If you do not explain how you arrived at an answer, no credit will be given.
- <u>Tiebreakers</u>. In the event of a tie score ONLY, tiebreak points will be awarded. Question 1 will be worth 1 tiebreak point, Question 2 will be worth 2 tiebreak points, Question 3 will be worth 3 tiebreak points, and so on until Question 12, which will be worth 12 tiebreak points.
- <u>Pencils</u>. We have provided pencils for you to use. If you need additional pencils, ask.
- <u>Erasers</u>. Because you only have 60 minutes to solve these problems, we strongly recommend that you do not erase any work. If you try something and it doesn't lead to the correct answer, that's fine! Just leave the work on the page and keep going. Neatness does not count for this set of problems.
- <u>Calculators</u>. You may not use calculators of any kind for this contest. If you brought one to the contest, give it to the TA, who will return it to you when the contest is complete.
- <u>Scratch Paper</u>. You should have enough space to solve a problem directly where the question is written. If you still need more paper for your work, raise your hand and it will be provided.
- <u>Food</u>. No food in the contest room. All students will receive a snack ticket which can be used once the contest finishes.
- <u>Bathroom</u>. Because you have only 60 minutes for 12 problems, we strongly urge you to use the bathroom before or after not during the contest. If you must use the bathroom, raise your hand and inform the TA.
- <u>Definitions</u>. If you do not understand what a word means, raise your hand and ask the TA quietly. **You may not ask for any help/hints on how a problem should be solved.** You may only ask questions if you do not know a specific word. Part of the challenge is reading the problems and figuring out what method must be used to solve them.
- <u>Suggestion</u>. Read the questions CAREFULLY before you solve, because sometimes one word can change the entire solution!
- <u>Time</u>. You will be allowed 60 minutes for the competition. <u>Do not open this booklet until time starts</u>. Once time begins, if you finish early, you have two options: check your work (strongly suggested), or turn in the contest early and be dismissed for the remaining time. If you leave early, you may not return to change any answers, so don't leave early unless you know you are completely finished.

Thank you for participating! Remember to HAVE FUN with these challenging (and somewhat ridiculous) problems.

Answer Key (DO NOT DETACH THIS PAGE)

#1	#2	#3
#4	#5	#6
#7	#8	#9
#10	#11	#12

Sude Yazgan Improving Students Division

Remember: SHOW WORK to receive credit!

#1.

Express the following as a single number:

 $(5 \times 18) + (6 \times 19) + (7 \times 20) + (8 \times 21) + (9 \times 22) - (4 \times 18) - (5 \times 19) - (6 \times 20) - (7 \times 21) - (8 \times 22)$

#2. Randomia collects photos of exotic birds. If you take the total number of bird photos she has and divide it by 7, then subtract 8, then multiply by 9, and finally add 10, you get 109. What is the number of bird photos in Randomia's collection?

#3. Numerica begins writing two-digit counting numbers starting with 50 and working her way up (50, 51, 52, and so on) until she reaches the first pair of consecutive numbers whose <u>digits</u> have a combined sum which is a two-digit even number greater than 20. What is the sum of this pair of consecutive numbers?

#4. After talking back to Grandma Sinko, Grandson Rinko is tasked with organizing Grandma Sinko's huge collection of silverware. He begins by sorting the forks. If he puts them in groups of 4, there are three forks left over. If he puts them in groups of 6, there are still three forks left over. If he puts them in groups of 12, how many forks will be left over?

#5. MohNay has 21 total coins that have a total value of 87 cents. Her coins are pennies (1 cent each), nickels (5 cents each), dimes (10 cents each), and quarters (25 cents each). She has twice as many dimes as quarters and twice as many pennies as nickels. How many nickels does MohNay have?

#6. To remind him of Harrison Chen's service as a TA, Mr. G. creates an H-shrine as shown below. The design is made up of congruent (equal-sized) squares whose total area is 700 square meters. In meters, what is the perimeter of the H-shrine?



#7. Sude must prepare fruit for dessert while her grandparents are visiting. Unfortunately, she does not plan ahead and has to go to the nearest store, Ridiculously Overpriced Food (Ridofo for short). At Ridofo, Sude can buy 2 watermelons and 3 apples for \$31. She can also buy 3 tangerines and 4 apples for \$27, or she can buy 4 tangerines and 5 watermelons for \$75. "These prices are outrageous!" Sude shouts. "All I need are 2 watermelons, 2 apples, and 2 tangerines. I only have \$25 with me. I don't think it's enough!" In dollars, how much more money must Sude bring with her to pay for what she needs at Ridofo?

#8. Consider the distance between the letters A and B to be 1, the distance between A and C to be 2, the distance between A and D to be 3, and so forth. Using the phrase below, find the sum of all the distances between each pair of letters using a starting value of T = 2.

Example: if the starting value of A is 3, then the phrase AED has a sum of 8 because from A to E = 4 and from E to D = 1. Thus, 3 (the starting value of A) + 4 + 1 = 8.

T H E T I N G G O E S S K R A A A A A

#9. Sude is concerned that one of her jealous classmates will steal her college acceptance letters, so she stashes them in a safe that is protected by a 5-digit code with the following properties:

- The 4th digit is four more than the 2nd digit.
- The 3^{rd} digit is three less than the 2^{nd} digit.
- The 1st digit is three times the 5th digit.
- Three different pairs of digits add up to 11.

What is the code to Sude's safe?

#10 (**Hard**). Each of the digits 1 through 9 is to be placed, 1 per box, in the figure below, replacing the nine letters such that all of the following statements are true:

- A + B + C = 17
- $T \div U V = 1$
- X ÷ Y Z = 0
 A + T X = 4
- $\mathbf{A} + \mathbf{I} = \mathbf{X} = \mathbf{4}$ • $\mathbf{B} \div \mathbf{U} \times \mathbf{Y} = 12$
- $\mathbf{C} \times \mathbf{V} \div \mathbf{Z} = 27$

А	В	С
Т	U	V
X	Y	Z

What is the value of the product $Y \times A \times Z$?

#11 (**Really Hard**). A number is considered "Awesome" if it is divisible by the sum of its digits. How many 2-digit Awesome numbers exist? #12 (**Crazy**). José and Ricardo have a conversation after both talking to Matty separately. They try figuring out what Matty's favorite pizza is. Matty has given them a list of 13 possible options:

- Thin Crust with Veggies
- Thick Crust with Pepperoni
- Thin Crust with Cheese
- Gluten-Free Crust with Veggies
- Deep Dish Crust with Ham
- Thin Crust with Bacon
- Gluten-Free Crust with Cheese
- Thin Crust with Ham
- Thick Crust with Pineapple
- Deep Dish Crust with Cheese
- Thick Crust with Ham
- Thin Crust with Pineapple
- Gluten-Free Crust with Pineapple

José knows the type of crust, while Ricardo knows the type of topping, and that is all they know. José states, "I don't know what Matty's favorite is, but I'm sure you don't know either." Ricardo replies, "Really! I originally didn't know, but now I do!" José comments, "Well then, so do I!"

What is Matty's favorite pizza?