#### 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	<b>#9</b>
#10	#11	#12

### **Bidipta Sarkar Elementary Masters Division**

Remember: SHOW WORK to receive credit!

#1. 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?

#2. 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?



#3. 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

#4. Having lost all his socks chasing after Rachalapoothichacha, Bidipta goes to Target and buys 12 pairs of socks at a total cost of \$24. Some of the socks cost \$1 a pair. Some cost \$3 a pair, and some cost \$4 a pair. If Bidipta bought at least 1 pair of each, how many pairs of \$1 socks did he buy?

#5. Kriti flies to Italy to visit the Milli Vanilli family. There are five kids: Billy, Dilly, Filly, Willy, and Silly. Today, Dilly is three years older than Billy. Seven years from now, Billy will be twice as old as Silly will be. In two years, Dilly will be twice as old as Willy will be and four times as old as Silly will be. Four years ago, Dilly was both twice as old as Filly and five times as old as Willy at that time. What is the current combined ages of all five Milli Vanilli kids?

#6. 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 4<sup>th</sup> digit is four more than the 2<sup>nd</sup> digit.
- The  $3^{rd}$  digit is three less than the  $2^{nd}$  digit.
- The 1<sup>st</sup> digit is three times the 5<sup>th</sup> digit.
- Three different pairs of digits add up to 11.

What is the code to Sude's safe?

#7. 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
- $\mathbf{T} \div \mathbf{U} \mathbf{V} = \mathbf{1}$
- 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  $Y \times A \times Z$ ?

#8. Great Uncle Venkatesh travels to Rome to negotiate a trade agreement with the Emperor Nachocheesius. At first, Nachocheesius is not willing to agree to any terms, so Great Uncle Venkatesh makes the following offer. "Emperor Nachocheesius, on whatever day of the month you select, I will provide you with that many pounds of cheese. For example, if you call me on August 1, I will bring you 1 pound of cheese. If you call me on August 2, I will bring you 2 pounds of cheese, and so on all the way until August 31."

Emperor Nachocheesius agrees to these terms, but only on the condition that Great Uncle Venkatesh can fly back to Rome immediately when called and provide the exact amount of cheese. Great Uncle Venkatesh realizes that he needs to have his cheese pre-cut into blocks, but he doesn't have room in his refrigerator for 31 different sized blocks of cheese, nor would he be able to transport that much cheese on the airplane anyway. "I've got it!" he shrieks suddenly. "Using 5 different size blocks of cheese, I will be able to cover any day of the month that Nachocheesius calls, provided I can add blocks together to make the desired number of pounds."

Indeed, Great Uncle Venkatesh can do exactly as he stated. What is the product of these five different cheese blocks (by weight in pounds)?

#9. How many different combinations of pennies, nickels, dimes, and quarters use exactly 48 coins to make \$1.00?

#10 (**Hard**).

A number is considered "Awesome" if it is divisible by the sum of its digits. How many 2-digit Awesome numbers exist? #11 (**Really Hard**). In the following problem, different letters represent different digits, but the same letter represents the same digit in both the cryptarithm on the left and the number grid on the right. The letter O is equal to zero. C and E are neither prime numbers nor perfect squares. A, B, and C form a line in the number grid, which has the property that the sum of the numbers in each row, column, and diagonal are equal. What is the difference between the product of the center and right-hand numbers in the top row (of the grid) and the left-hand number in the top row (of the grid)?

 $\begin{array}{c} A B C C \\ + D E F F \\ \overline{G O O G O} \end{array}$ 

Н	
D	G

#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?