

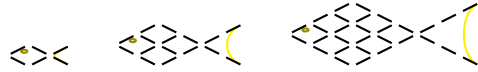
Math 123  
Fall 2023  
Dr. Lily Yen

# Midterm I

Show all your work

Name: \_\_\_\_\_  
Number: \_\_\_\_\_  
Signature: \_\_\_\_\_  
Score: \_\_\_\_/30

**Problem 1:** Anjali used toothpicks to form a sequence of fish.



- Draw the fourth fish in the sequence.
- Count the total number of toothpicks in the fourth fish.
- Establish a table of pattern to obtain a formula involving  $n$  to express the total number of toothpicks in the  $n$ th fish.

Score: \_\_\_\_/4

**Problem 2:** The sum of Katharina's parents' ages is 118. Given that her father is two years older than her mother, find their ages.

Score: \_\_\_\_/2

**Problem 3:** Lena-Anna is a Michelin-Starred restaurant with tables which seat 4 or 2. Suppose there are 5 more tables which are 2-seaters than 4-seaters. At capacity, the restaurant serves 40 people. How many tables of each type does Lena-Anna have?


Score: \_\_\_\_/2


**Problem 4:** Mei rolls a six-sided die, an eight-sided die, and a twenty-sided die simultaneously. How many possible outcomes are there? Use a tree diagram to support your answer.

Score: \_\_\_\_/2

/10
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**Problem 5:** Fire Horse is looking at the following from different numeration systems. Convert each to a Hindu-Arabic numeral, and perform indicated operations.

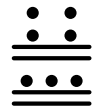
a. 

b. 

c. MCDLXIX

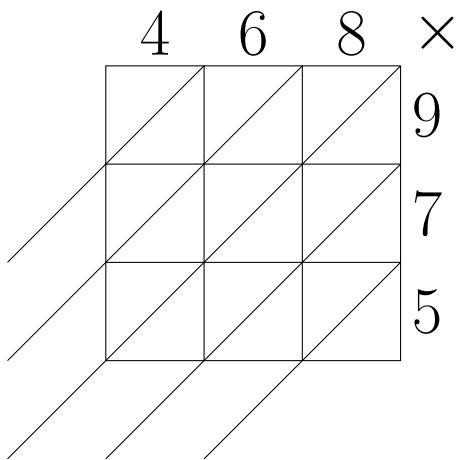
d. Perform the subtraction  $1010011_2 - 11011_2$  in binary, then convert each binary including the answer to base-10 to check.

e. Convert  $A3B_{16}$  to an octal number.

f. 

Score: /11

**Problem 6:** Multiply  $468 \times 975$  using the galley method.



Score: /3

**Problem 7:** Find three different values for  $x$  satisfying  $x + 3 \equiv 5 \pmod{13}$ .

Score: /3

**Problem 8:** A group of students are attending a seminar at the university auditorium. There are chairs arranged to the left and to the right of the podium. Chairs on the left are arranged 7 in a row, and chairs on the right are arranged 10 in a row. If all students sit on the left, from the first row on, without any empty seat, there are exactly 5 students in the last row before empty rows. If all students sit on the right, again filling all seats from the first on, there are exactly 2 students in the last row before empty rows. Find the second smallest number of students that attend the seminar.

Score: /3