# WINMAC

Name: _____ Score: _____ / 45

PLEASE DO NOT FILL IN ABOVE! (the "SCORE" blank)

Grade: _____ Team: _____

This is a round consisting of **9 problems** that is to be done in **35 minutes**. The problems are split into **3 themes**, which are in ascending difficulty. The problems within each theme are also in ascending difficulty. For example, **problem 3 in category 3 is significantly harder than problem 3 in category 1**. The problems are each worth **5 points**.

No aids are permitted aside from pencils, pens, and provided scratch paper. In particular, no calculators or other computers are permitted. Communication with other people is not permitted.

Record your answers in the box corresponding to the correct problem. Only answers printed in the boxes below will be scored.
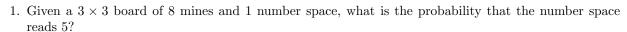
## Your Answers

| Magical Minesweeper | Fun Factorials | Jason the Duck |
|---|---|---|
| 1. | 4. | 7. |
| 2. | 5. | 8. |
| 3. | 6. | 9. |

## Magical Minesweeper

*In the game Minesweeper, there are mines, number spaces, and blank spaces. Number spaces dictate how many mines are there in the $3 \times 3$ square surrounding a specific $1 \times 1$ tile.*

1. Given a $3 \times 3$ board of 8 mines and 1 number space, what is the probability that the number space reads 5?

2. Consider a $19 \times 19$ minesweeper board. How many squares can have be a number square with value 6?

3. How many ways are there to place 3 mines on a $4 \times 4$ minesweeper board?

**Note:** Do kids these days still play Minesweeper?

**WINMAC**

## Fun Factorials

*A factorial of a natural number is the product of that natural number and all natural numbers below it. For example:* $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$. *Likewise,* $10! = 10 \cdot 9 \cdot ... \cdot 2 \cdot 1$.

1. Evaluate $\frac{12!+11!}{10!+9!}$

2. What is the largest value $x$ for which 20! is divisible by $(4!)^x$?
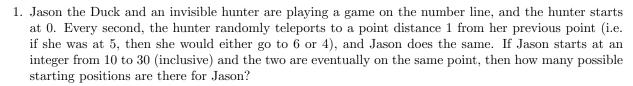
3. Find the number of factors of $5! + 6! + 7!$

**Note:** The "fun" part is not guaranteed.

## Jason the Duck

1. Jason the Duck and an invisible hunter are playing a game on the number line, and the hunter starts at 0. Every second, the hunter randomly teleports to a point distance 1 from her previous point (i.e. if she was at 5, then she would either go to 6 or 4), and Jason does the same. If Jason starts at an integer from 10 to 30 (inclusive) and the two are eventually on the same point, then how many possible starting positions are there for Jason?

2. Jason the duck plays hide and seek with his owner Robert. Jason has 4 boxes in which he can hide in. In each round, Jason must hide in a box where he has not hidden previously and Robert can check one box which he has not checked previously. Robert wins if he finds Jason within 2 rounds. What is the probability that Robert will win?

3. Jason the Duck and Todd the Turtle are participating in a 100-meter swimming competition. In still water, Jason can finishes the race 10 seconds faster than Todd. However, on race day, there a strong 5 m/s current so that Jason only finished 2 seconds faster. What was Todd's time from the race?

**Note:** Jason is one of the problem writers for WinMaC who greatly resembles a duck (agreed unanimously by the WinMaC staff).