Binary 2022

Reward	Penalty
100	-10

What is the binary (base 2) representation of the decimal number 2022 + (20 + 2 + 2)?

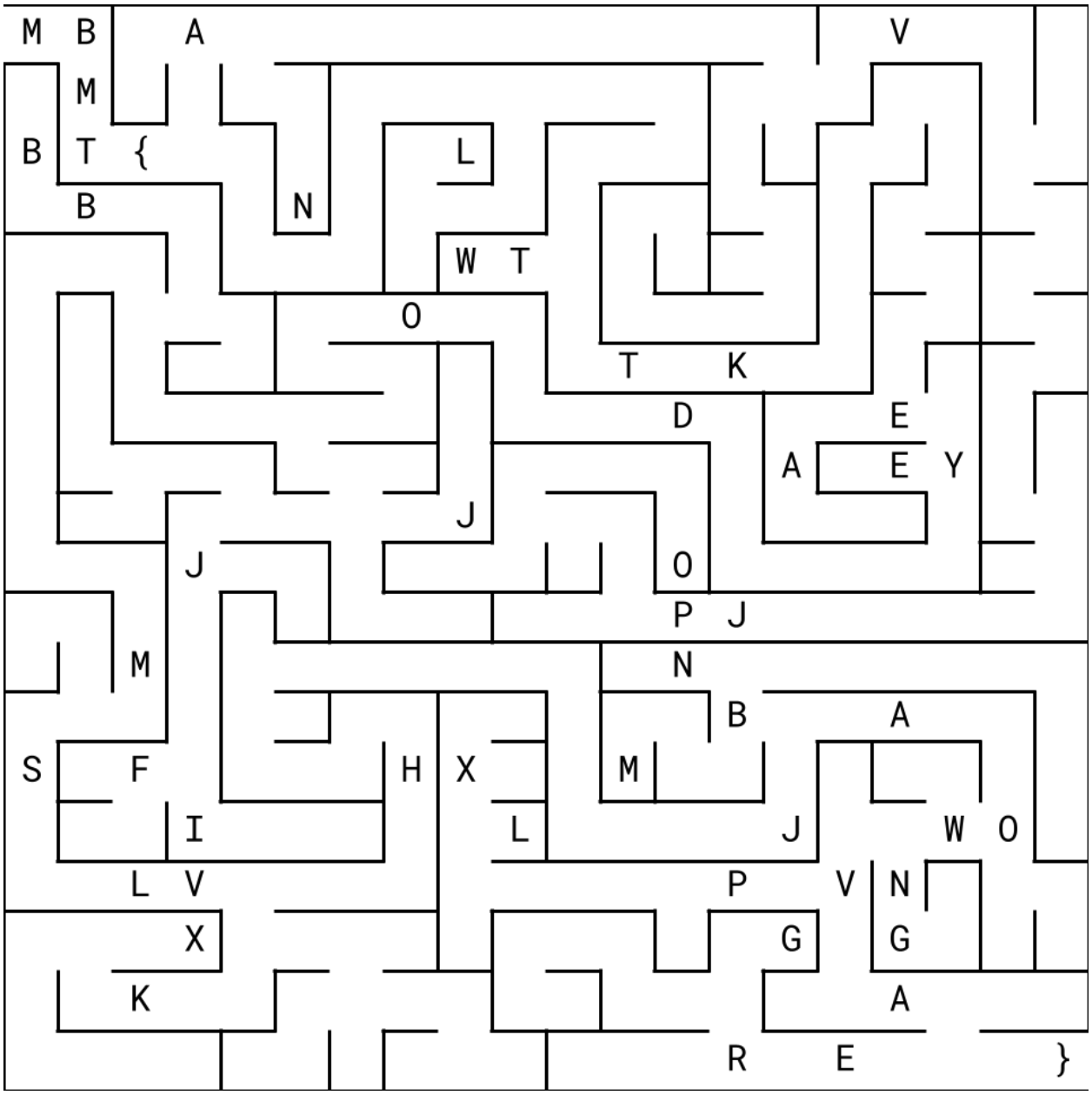
For example, the decimal number 11 is written “1011” in binary because $11 = 2^3 + 2^1 + 2^0 = 1011_2$.

Wrap your answer in `MBMT{}`.

Amaze

Reward
150

Penalty
-10



Curious Crossword

Reward	Penalty
250	-25

A	*B*
C	*D*

Guidelines

1. *A*, *B*, *C*, and *D* are (not necessarily distinct) digits from 0 to 9.
2. There are four two-digit numbers such that $AB \le AC \le BD \le CD$.
3. Find *A*, *B*, *C*, and *D* such that each of the following exists exactly once among the four two-digit numbers.
    a. Factorial:
        i. A number that can be expressed by $n \cdot (n-1) \cdot \ldots \cdot 1$ such that n is a positive integer
        ii. Example: 6 is a factorial because $6 = 3 \cdot 2 \cdot 1$.
    b. Fibonacci number:
        i. A series of numbers in which each subsequent number is the sum of the two preceding numbers starting with 0 and 1
        ii. Example: 5 is a Fibonacci number because 0 + 1 = 1, then 1 + 1 = 2, then 1 + 2 = 3, then 2 + 3 = 5.
    c. Perfect number:
        i. A positive integer that is equal to the sum of its positive divisors, excluding the number itself
        ii. Example: 6 is a perfect number because the positive divisors of 6 are 1, 2, 3, and 6, and 1 + 2 + 3 = 6.
    d. Perfect square:
        i. A number that can be expressed as an integer multiplied by itself
        ii. Example: 4 is a perfect square because $2 \cdot 2 = 4$.

`MBMT{ABCD}`

Example

If your square is

1	*2*
3	*4*

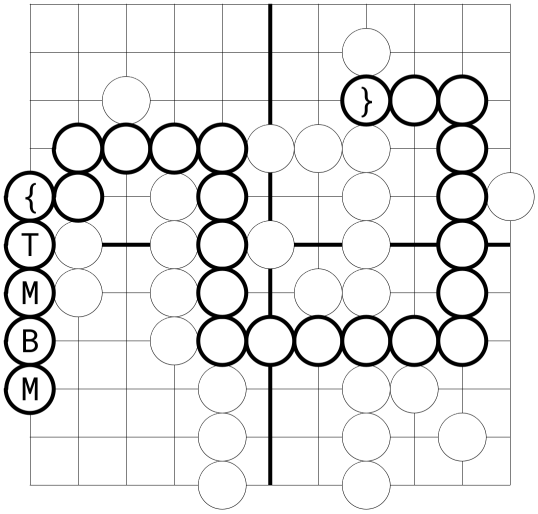
, you will submit `MBMT{1234}`.

Coordinate Crossword

Reward
300

Penalty
-50

This is an easier version of Curvy Crossword.



All letters are uppercase.

#	Begin	End	Clue
1	(-3, 3)	(4, -4)	Type of number that can have a numerator and denominator
2	(-4, 2)	(1, 2)	Set of all points at a given radius from a given center
3	(-4, 2)	(-4, -1)	3D shape with 6 square faces
4	(-2, 2)	(-2, -2)	Type of angle measuring 90°
5	(2, 2)	(2, -5)	Result of division
6	(-1, 1)	(-1, -5)	Part of math dealing with symbols
7	(5, 1)	(2, 4)	Name given to the side chosen as the bottom of a triangle
8	(4, 0)	(4, 3)	Synonym of “average”
9	(4, -2)	(4, -1)	Ratio of a circle’s circumference to its diameter
10	(4, -2)	(0, -2)	Integer greater than 1 with exactly two positive factors

Secretive Seven

Reward
400

Penalty
-50

ALGEBRA
ANGLE
CIRCLE
KNOW
LAW
LINE
MATHEMATICS
MBMT
MULTIPLY
NTH
NUMBER
PLANE
PRIME
PROBABILITY
PYRAMID
RAY
SQUARE
SUM

M	U	L	T	I	P	L	Y	P
A	R	B	E	G	L	A	T	Y
T	E	W	H	Y	S	S	I	R
H	B	I	X	A	F	R	L	A
E	M	I	R	P	A	I	I	M
M	U	S	A	D	O	L	B	I
A	N	Q	Y	F	S	M	A	D
T	E	U	E	V	T	N	B	W
I	N	A	E	N	G	T	O	O
C	I	R	C	L	E	H	R	N
S	L	E	E	N	A	L	P	K

Use the leftover letters once all 18 words are found and submit your answer as follows.
MBMT{_______ _____ ___ ____}

Desolate Diagonal

Reward
450

Penalty
-50

		3	6			5	1	
			8	1			7	6
6				5	3			9
3	2				5	7		
	5	1				6	3	
		6	3				4	5
7			1	3				8
1	3			8	6			
	4	8			9	1		

Sudoku Rules

1. In each column, each of the digits 1–9 appear once.
2. In each row, each of the digits 1–9 appear once.
3. In each bolded 3×3 box, each of the digits 1–9 appear once.

Instructions

Once the Sudoku is solved, record the numbers along the diagonal from the top left to the bottom right.

`MBMT{_________}`

Minesweeper Prophet

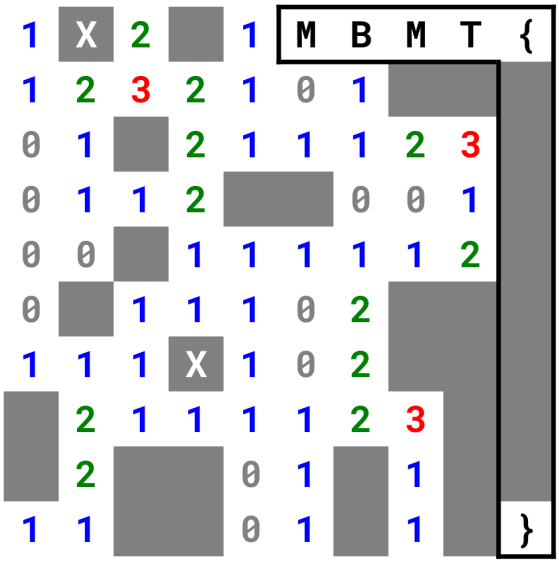
Reward	Penalty
500	-100

You're playing *Minesweeper* on a computer. Suddenly, the game freezes, and you can't interact with it anymore.

You remember that the computer generated the grid with 14 flags. From the game below, can you predict the remainder of the grid?

Minesweeper Rules

1. The game is played over a rectangular grid of hidden tiles.
2. At the start of the game, an unknown subset of the tiles is flagged.
3. You can mark a tile as flagged with an X.
4. The tiles not flagged are considered "safe".
5. Each safe tile is labeled with the number of adjacent flags (including diagonally adjacent).
6. Clicking on any hidden tile "opens" it and reveals the contents underneath.
7. You win the game by opening all safe squares but lose if you open a flagged tile.



Caesar

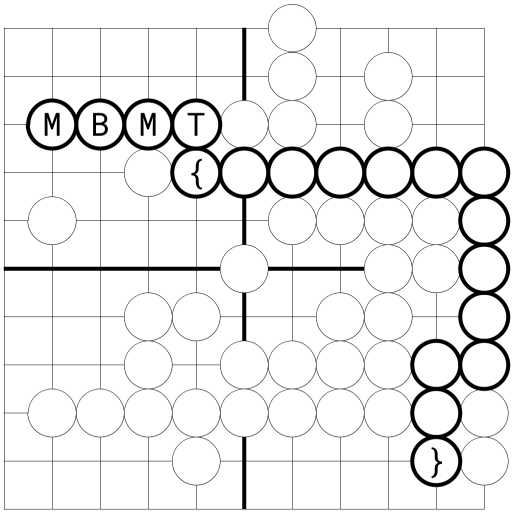
Reward	Penalty
550	-50

ZOZG{RAIL_SYNC_BE_ONE_ANT}

Curvy Crossword

Reward	Penalty
600	-50

This is a more challenging version of Coordinate Crossword.



All letters are uppercase. t is an integer starting from 0.

#	Coordinates	Clue
1	$(1, 5 - t)$	Author of the mathematical treatise *Elements*
2	$(2 - t)(2, 1)$	Infinite figure uniquely defined by two points
3	$(2t - 4, 3 - \lvert t - 2 \rvert)$	Statement assumed to be true without proof
4	$(3, t - 1)$	A unit of measure for angle
5	$(3, -1) + t(1, 1)$	Figure that extends infinitely in only one direction
6	$(t, t^2) - (2, 2)$	Symbol for normalizing a vector
7	$(0, -2) + t(1, 0)$	Conventional inverse of the sine function
8	$(t - 4, -3)$	Polynomial of degree 2
9	$3t(1, 1) - (1, 4)$	Unordered collection of distinct objects
10	$(5, t - 4)$	Category of shapes including ellipses and parabolas

Obstacle

Reward	Penalty
750	-50

This puzzle must be completed in the SAC Courtyard. You're supplied one meter stick.

Measure the distance between the two marked points on the sidewalk to the nearest tenth of a meter.

Wrap your answer in `MBMT{}`. Two possible answers are `MBMT{7.3}` and `MBMT{12.0}`.