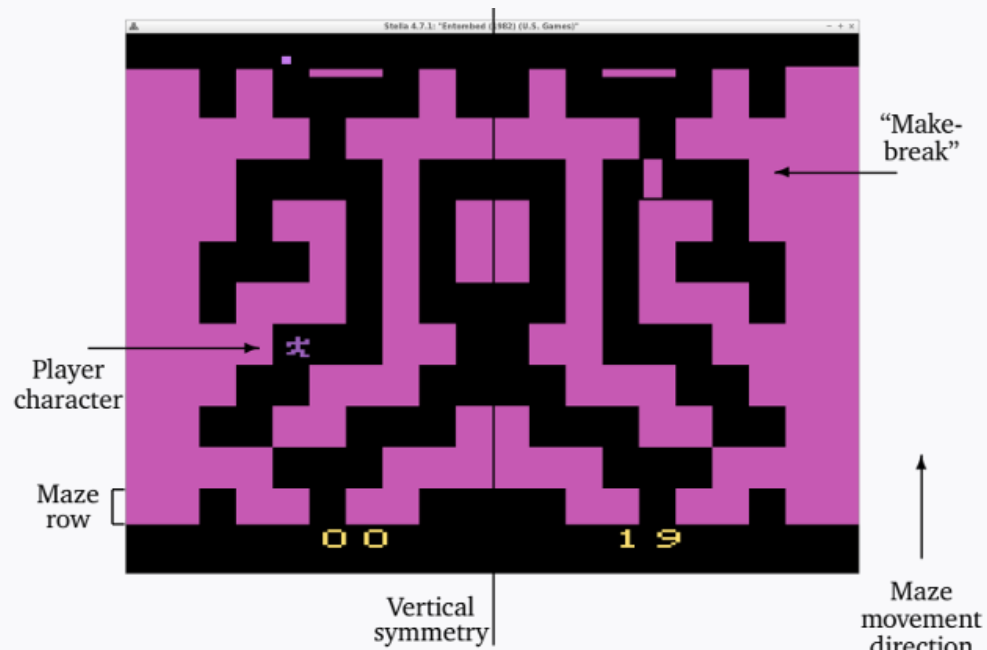# Q1 Honor code & acknowledgements
5 Points

In this fartlek you'll be able to explain this "mystery table" in Entombed, an old Atari 2600 maze-generation **videogame** that people who should know better called, "impossible to explain."

Figure 5 Entombed game screen, highlighting design and gameplay aspects

Read the details here and keep the mystery table on page 2 handy.

This is an unusual fartlek assignment, because you MUST come to office hours on Zoom and discuss it with a TA/LA, who will give you their signature code. (It is an honor code violation to use a signature code without having come to office hours -- the point is for all to see how many office hours there are, and how useful smaller discussion groups can be.) Good scholarship requires that you acknowledge collaborators and sources.

Students who took this class last semester will have seen this already; help your classmates to discover the answers, rather than just giving answers. Fartleks are scored to a large part on participation.

⊙ I confirm that I am submitting my own writing or typing

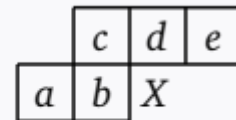I acknowledge these collaborators and sources:

TA signature code:

sam29

Q2 Rule 2x2
2 Points

The game scans left to right and chooses bit X to be blank (0), wall (1), or random by looking at two bits to the left and three above in this pattern:

	c	d	e
a	b	X	

■ Figure 6 Maze wall context used to select a new bit

These bits index into a truth table of $2^5 = 32$ rows to generate the next bit X. Aycock and Copplestone call it a "mystery table," but most of it is easy to explain. You will make a slightly different table of $2^5 = 32$ rows, and compare it with the mystery table.

For a good "Entombed" maze, you want to avoid generating a 2x2 blank (all 0s), a 2×2 block (all 1s), or a 2×2 checkerboard.

Q2.1 Rule 2x2 test
1 Point

Give a logic formula in b, c, d that tests if there is a danger that X may complete a 2x2 blank (all 0s), a 2×2 block (all 1s), or a 2×2 checkerboard, and a way to set X so that it does not.

Plain text or LaTeX is fine, no spaces. Copyable symbols: ¬ ∧ ∨ ➜ ↔ ⊕
= ≠

IF

$$b \leftrightarrow d$$

THEN set the value $X =$

$$\bar{c}$$

Q2.2 Exception to Rule 2x2
1 Point

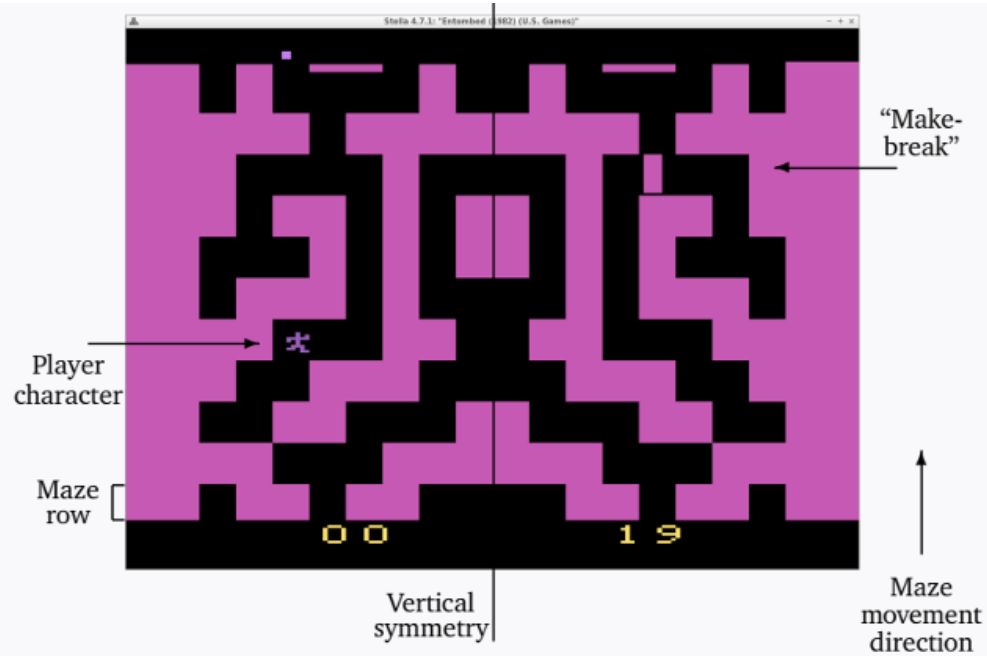What is the one exception to your Rule 2×2 in the mystery table?
Hint: It allows the checkerboard 2×2 that the player is headed toward in the picture below.

For the row with this bit pattern: *Type 5 bits (each 0 or 1), no spaces*

11011

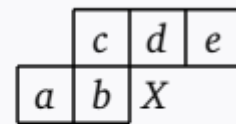the game assigns X to a random bit, instead of to: *Type a 0 or 1*

1

Figure 5 Entombed game screen, highlighting design and gameplay aspects

Q3 Rule Nbr
3 Points

Figure 6 Maze wall context used to select a new bit

To avoid an isolated wall or blank, every bit should match one of its four neighbors. If a neighbor of X does not already have a matching neighbor among a, b, c, d, e, let's make X be the match.

Q3.1 Assign Nbr b
1 Point

Give a logic formulas in any of a, b, c, d, e to test if X must be the same as b.

Plain text or LaTeX is fine, no spaces. Copyable symbols: ¬ ∧ ∨ ➜ ↔ ⊕ = ≠

IF

$$(a \leftrightarrow c) \wedge (a \oplus b)$$

THEN assign $\mathbf{X} = \mathbf{b}$.

Q3.2 Assign Nbr d
1 Point

Give a logic formulas in any of a, b, c, d, e to test if X must be the same as d.

Plain text or LaTeX is fine, no spaces. Copyable symbols: ¬ ∧ ∨ ➔ ↔ ⊕
= ≠

IF

$$(c \leftrightarrow e) \wedge (c \oplus d)$$

THEN assign $\mathbf{X} = \mathbf{d}$.

### Q3.3 No Conflict Possible
1 Point

Argue that there can be no conflict between the two Rule Nbr cases: That if $b \neq d$, it will never try to assign both $X = b$ and $X = d$.

When comparing the two logical formulas and the truth tables they produce given all possible combinations of a, b, c, d, and e, we see that there are two possible outcomes where both formulas will evaluate to True: when the sensor bits are 10101 and 01010, potentially leading to a conflict.

However, in both of these cases bits b and d are always the same: 1[0]1[0]1 and 0[1]0[1]0. Meaning there should be no situation where the game must assign X a conflicting value.

Q4 The Key Exception

2 Points

	c	d	e
a	b	X	
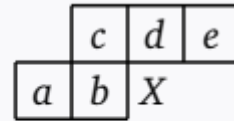
■ **Figure 6**   Maze wall context used to select a new bit

In the remaining patterns in the mystery table, it should be OK to choose X randomly, since Rule 2×2 eliminates the unwanted 2×2 patterns and Rule Nbr sets those that need X as a neighbor.

Table 1 Mystery table mapping used for maze generation

a	b	c	d	e	X
O	O	O	O	O	I
O	O	O	O	I	I
O	O	O	I	O	I
O	O	O	I	I	random
O	O	I	O	O	O
O	O	I	O	I	O
O	O	I	I	O	random
O	O	I	I	I	random
O	I	O	O	O	I
O	I	O	O	I	I
O	I	O	I	O	I
O	I	O	I	I	I
O	I	I	O	O	random
O	I	I	O	I	O
O	I	I	I	O	O
O	I	I	I	I	O
I	O	O	O	O	I
I	O	O	O	I	I
I	O	O	I	O	I
I	O	O	I	I	random
I	O	I	O	O	O
I	O	I	O	I	O
I	O	I	I	O	O
I	O	I	I	I	O
I	I	O	O	O	random
I	I	O	O	I	O
I	I	O	I	O	I
I	I	O	I	I	random
I	I	I	O	O	random
I	I	I	O	I	O
I	I	I	I	O	O
I	I	I	I	I	O

Q4.1 Key Exception
1 Point

What is the exception that is not random in the mystery table?

The row pattern: *Again, type 5 bits, no spaces*

11001

is not assigned randomly, but fixed to: *Type 0 or 1*

0

Q4.2 Explain the Key Exception
1 Point

Explain why the game may be better when that value identified in **Q4.1** is not random, but fixed to the chosen value. You'll probably also reference your Rule 2×2.

In the event that the signal bits are 11001, assigning a 1 will create a dead-end. When going forward two steps as if we were generating the maze one block at a time, this dead-end may become disjointed from other hallways in the game.

Fartlek: Entombed

● **GRADED**

STUDENT
Tom Nguyen

TOTAL POINTS
11.75 / 12 pts

QUESTION 1
Honor code & acknowledgements   **5** / 5 pts

QUESTION 2
Rule 2x2   **2** / 2 pts

| 2.1 | Rule 2x2 test | **1** / 1 pt |
| 2.2 | Exception to Rule 2x2 | **1** / 1 pt |

QUESTION 3

Rule Nbr **3** / 3 pts

3.1	Assign Nbr b	**1** / 1 pt
3.2	Assign Nbr d	**1** / 1 pt
3.3	No Conflict Possible	**1** / 1 pt

QUESTION 4

The Key Exception **1.75** / 2 pts

| 4.1 | Key Exception | **1** / 1 pt |
| 4.2 | Explain the Key Exception | **0.75** / 1 pt |