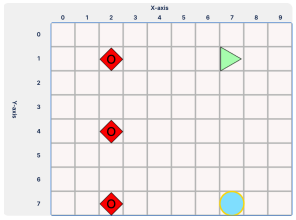
MAP A



A1 (AST: 3 , SC: 34)

from time 0 to 30 ALWAYS x > 6
AND
from time 6 to 30 EVENTUALLY x < 8
AND
from time 6 to 30 ALWAYS y = 1

A2 (AST: 3 , SC: 34)

from time 0 to 30 ALWAYS x > 6
AND
from time 6 to 30 EVENTUALLY x < 8
AND
from time 6 to 30 EVENTUALLY y = 1

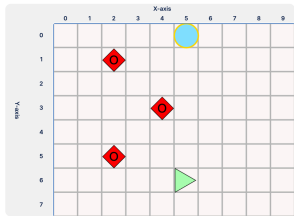
A3 (AST: 4, SC: 48)

(
from time 0 to 30 ALWAYS x > 4
OR
from time 0 to 30 ALWAYS x < 1
)
AND
from time 15 to 25 ALWAYS x = 7
AND
from time 16 to 18 ALWAYS y = 1

A4 (AST: 4 , SC: 50)

(
from time 0 to 30 ALWAYS x > 4
OR
from time 0 to 30 ALWAYS x < 1
)
AND
(
from time 15 to 25 ALWAYS x = 7
OR
from time 16 to 18 ALWAYS y = 1
)

MAP B



B1 (AST: 3 , SC: 46)

from time 0 to 2 ALWAYS y < 2
AND
from time 2 to 25 ALWAYS x > 5
AND
from time 26 to 30 ALWAYS y = 6
AND
from time 26 to 30 EVENTUALLY x = 5

B2 (AST: 3 , SC: 46)

from time 0 to 2 ALWAYS y < 2
AND
from time 2 to 25 ALWAYS x > 5
AND
from time 26 to 28 ALWAYS y = 6
AND
from time 26 to 30 EVENTUALLY x = 5

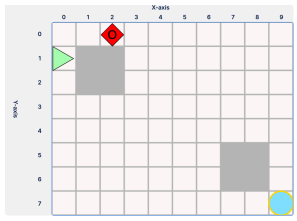
B2 (AST: 3 , SC:46)

from time 4 to 12 ALWAYS x = 9
AND
from time 15 to 30 ALWAYS y > 5
AND
from time 16 to 30 ALWAYS x = 5
AND
from time 18 to 30 ALWAYS y < 7

B4 (AST: 3 , SC: 46)

from time 4 to 12 ALWAYS x = 9
AND
from time 15 to 30 EVENTUALLY y > 5
AND
from time 16 to 30 ALWAYS x = 5
AND
from time 18 to 30 ALWAYS y < 7

MAP D



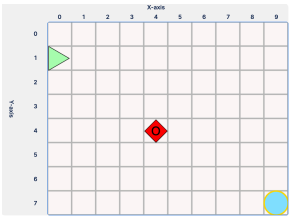
D1 (AST: 3 , SC: 34)

from time 0 to 30 ALWAYS y > 0
AND
from time 10 to 30 ALWAYS x = 0
AND
from time 10 to 30 EVENTUALLY y = 1

D2 (AST: 3 , SC: 34)

from time 0 to 30 ALWAYS y > 0
AND
from time 10 to 30 EVENTUALLY x = 0
AND
from time 10 to 30 EVENTUALLY y = 1

MAP E



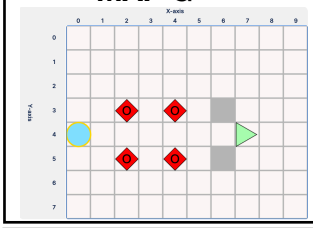
E1 (AST: 5 , SC: 64)

(
(
from time 0 to 10 ALWAYS x > 6
AND
from time 10 to 30 ALWAYS y = 1
)
OR
(
from time 0 to 10 ALWAYS y > 5
AND
from time 10 to 30 ALWAYS x = 0
)
)
AND
from time 10 to 30 EVENTUALLY y = 1

E2 (AST: 5 , SC: 64)

from time 0 to 30 ALWAYS x > 6
AND
from time 6 to 30 EVENTUALLY x < 8
AND
from time 6 to 30 EVENTUALLY y = 1

MAP G



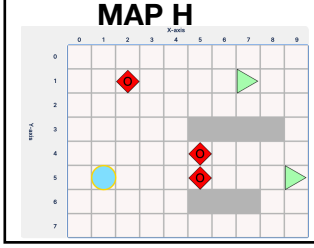
G1 (AST: 4 , SC: 67)

from time 0 to 4 ALWAYS x = 0
AND
from time 4 to 10 ALWAYS (y > 6) OR (y < 2)
AND
from time 10 to 30 ALWAYS x ≥ 6
AND
from time 10 to 30 EVENTUALLY (x = 7) AND (y = 4)

G2 (AST: 4 , SC:52)

from time 0 to 4 ALWAYS x = 0
AND
from time 4 to 10 ALWAYS (y > 6) OR (y < 2)
AND
from time 10 to 30 EVENTUALLY (x = 7) AND (y = 4)

MAP H



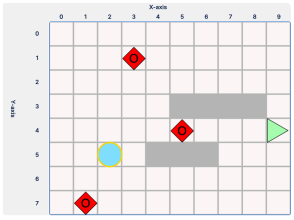
H1 (AST: 4 , SC: 52)

from time 2 to 10 ALWAYS y = 7
AND
from time 10 to 12 EVENTUALLY (x = 9) AND (y = 5)
AND
from time 12 to 20 EVENTUALLY (x = 7) AND (y = 1)

H2 (AST: 4 , SC: 52)

from time 2 to 10 ALWAYS y = 7
AND
from time 10 to 20 EVENTUALLY (x = 9) AND (y = 5)
AND
from time 20 to 30 EVENTUALLY (x = 7) AND (y = 1)

MAP F



F1 (AST: 4 , SC: 49)

from time 0 to 30 ALWAYS x ≥ 2
AND
from time 0 to 9 ALWAYS NOT (y = 4)
AND
from time 0 to 12 EVENTUALLY (x = 9) AND (y = 4)

F2 (AST: 4 , SC: 49)

from time 0 to 30 ALWAYS x ≥ 2
AND
from time 0 to 9 ALWAYS NOT (y = 4)
AND
from time 0 to 14 EVENTUALLY (x = 9) AND (y = 4)

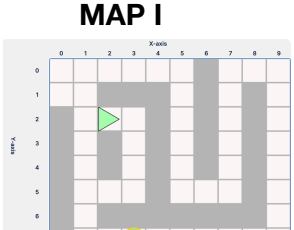
F3 (AST: 4 , SC: 79)

from time 0 to 2 ALWAYS x = 2
AND
from time 2 to 4 ALWAYS y = 3
AND
from time 2 to 4 EVENTUALLY x = 4
AND
from time 5 to 15 ALWAYS (y = 2) AND (x > 3)
AND
from time 15 to 30 ALWAYS x = 9
AND
from time 15 to 30 EVENTUALLY y = 4

F4 (AST: 4 , SC: 79)

from time 0 to 2 ALWAYS x = 2
AND
from time 2 to 4 ALWAYS y = 3
AND
from time 2 to 4 EVENTUALLY x = 4
AND
from time 10 to 15 ALWAYS (y = 2) AND (x > 3)
AND
from time 15 to 30 ALWAYS x = 9
AND
from time 15 to 30 EVENTUALLY y = 4

MAP I



I1 (AST: 5 , SC: 43)

from time 0 to 10 EVENTUALLY (x = 2) AND (y = 2)
AND
from time 0 to 8 ALWAYS NOT
(
x = 9
AND
y = 5
)

I2 (AST: 4 , SC: 47)

from time 0 to 20 EVENTUALLY (x > 8) AND ((y > 2) AND (y < 5))
AND
from time 0 to 30 EVENTUALLY (x = 2) AND (y = 2)

Supplementary Figure: All Maps and Specifications with AST Depth (AST) and Symbol Count (SC)

Introductory Content 1: This is the online survey content presented to users. All users receive the same survey content regardless of experiment condition.

Consent

You have been asked to participate in a research study conducted by [WITHHELD FOR ANONYMOUS REVIEW]

This project seeks to allow people to people to understand and interact with artificial intelligence (AI) agents. For this experiment, you will be asked to review a robot's rules and behaviors in various formats as it plays a game of capture the flag. We do not anticipate any risks or potential discomfort to you for participating in this experiment.

The personal information that we will ask about you includes your age and educational and work background for a few specific areas.

If you are performing the "talk-aloud" version of this experiment, audio and screen capture will also be taken during the experiment (but no videorecording).

It should not be possible to link the information from this experiment back to you specifically.

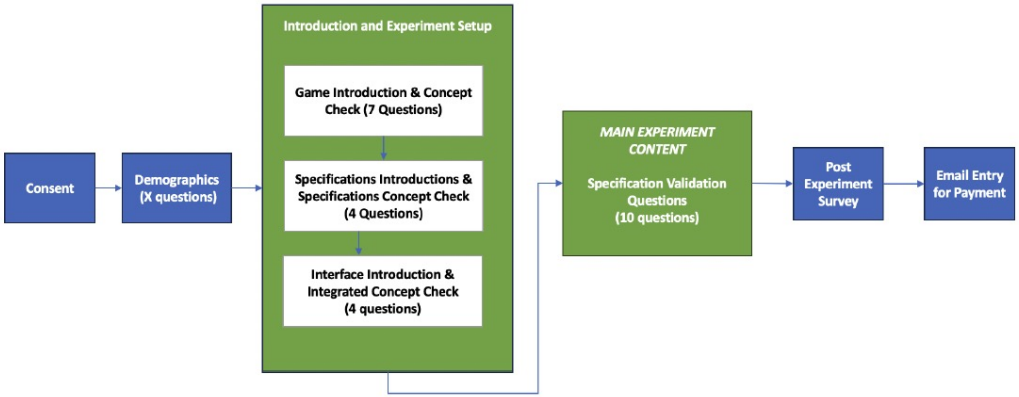
Experiment Procedure:

The flow of the experiment is as follows:

1) Demographics Survey
2) Introduction to the Experiment Setup (In Web Application)
3) Specification Validation Questions (In Web Application)
4) Post-Experiment Survey
5) Email Entry for Payment

You must complete this experiment in one sitting. The experiment is expected to take approximately 90 minutes to complete. The experiment supervisor will be available to answer any questions you may have throughout the experience.

Your participation in this study is completely voluntary and you are free to choose whether to be in it or not.



Note: The dotted arrows refer to transitions where you will be moving between this Qualtrics web platform and the experiment web application. All blue steps will be completed in Qualtrics and all green steps completed in the web application. Once you have completed the Demographics section you will be provided a link to access the web application to complete the Introduction and Specification Validation Sections. You will then be prompted to return to this page once you have completed those sections to finish the experiment and receive your payment.

Payment for Participation:

You will receive a **$15** for completing the experiment.

You may also earn up to an **additional $2 per question** you answer correctly in the 10 question Specification Validation section of the experiment. That means that the maximum potential payment for this experiment is **$35**.

By moving on to the next page, you are confirming that you are 18 years or older, have read and agree to the information above, and are voluntarily participating in this study.

Demographics

If you are entering this experiment through the Beh [WITHHELD FOR ANONYMOUS REVIEW] please provide your Sona ID below.

How old are you?

- ○ 18-24 years old
- ○ 25-34 years old
- ○ 35-44 years old
- ○ 45-54 years old
- ○ 55-64 years old
- ○ 65+ years old

What is the highest level of school you have completed?

- ○ Less than high school degree
- ○ High school graduate (high school diploma or equivalent, including GED)
- ○ Some college but no degree
- ○ Associate degree
- ○ Bachelor's degree
- ○ Master's degree
- ○ Doctoral degree, excluding professional degrees
- ○ Professional degree (JD, MD, etc)

Which of the following areas have you taken a class in or are familiar with? Select all that apply. You may assume introductory level for all.

- [ ] algebra
- [ ] geometry
- [ ] trigonometry
- [ ] calculus
- [ ] robotics
- [ ] logic

Please rate the frequency at which you use math (algebra, geometry, trigonometry, calculus, etc) in your day-to-day life.

	Monthly or less	Monthly to weekly	Weekly	Weekly to daily	Daily or near-daily
Frequency	○	○	○	○	○

Please rate the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I am experienced with formal logics, such as propositional calculus, first-order logic, formal verification, etc.	○	○	○	○	○
I am experienced with natural language processing and linguistics.	○	○	○	○	○
I am experienced in interacting with artificial intelligence (AI) agents.	○	○	○	○	○
I am experienced in developing AI agents.	○	○	○	○	○
I am experienced in using decision trees as an AI technique.	○	○	○	○	○
I am experienced in following decision trees manually for operational procedures.	○	○	○	○	○
I am experienced with logic based games such as Sudoku, Chess, LSAT logic puzzles etc.	○	○	○	○	○

You chose subject choice with regards to experience with formal logics. Please explain, and include years of experience/practice.

You chose subject choice with regards to experience with natural language processing and linguistics. Please explain, and include years of experience/practice.

You chose subject choice with regards to experience in interacting with artificial intelligence agents. Please explain, and include years of experience/practice.

You chose subject choice with regards to developing artificial intelligence agents. Please explain, and include years of experience/practice.

You chose subject choice with regards to using decision trees as an AI techniques. Please explain, and include years of experience/practice.

You chose subject choice with regards to following decision trees manually for operational procedures. Please explain, and include years of experience/practice.

You chose subject choice with regards to experience with logic games. Please explain, and include types of games and years of experience/practice.

This is the end of the demographics portion of the survey. The next portion will introduce you to the robot behavior experiment. You may proceed whenever you are ready.

Introduction and Specification Validation Sections (transition to web app)

You will complete the Introduction and Specification Validation sections of the experiment on a separate web application.

Once these are complete you will be provided a completion confirmation code to enter upon your return to this page. Click HERE to enter the web application.

Once you have completed all the material in the web application and are presented with the completion page enter the completion confirmation code below.

Post-Experiment

Thank you for completing the specification validation portion of the experiment.

In this last section, we would like to get your thoughts on the manner in which you went about the answering process.

Would your answers about confidence change depending on the complexity of the formula or scenario? If yes, please explain.

Did you use any notes or other mental aids during the validation? If so, please describe what you used and when you used it. If not, type "no".

Please share any other thoughts you have about how the specifications were presented.

Ending

Thank you for completing our experiment!

If you have any further comments about the experiment, please enter them below.

Email

Thank you for completing our experiment. Please enter your email below for payment after we tally your score.

Please enter your email again to confirm.

Introductory Content 2: Introduction Webpages

These are the series of webpages that each participant worked through at the beginning of the session. There were some differences between the material introduced to the 3 experimental groups. The top of each page is labeled with the condition(s) (**AL-WF, AL-NF, control)** who were introduced to that material.

When differences in material between group are small (simple textual differences) those are called out with a highlighted note. For pages where there are larger interface discrepancies the relevant pages are shown separately.

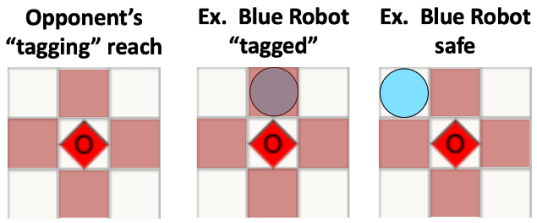
Game Introduction Webpage (**all participants**)

Welcome to the Experiment Platform!

The game rules are displayed in text below. Once you feel comfortable with these rules complete the concept check to proceed to the next introductory section.

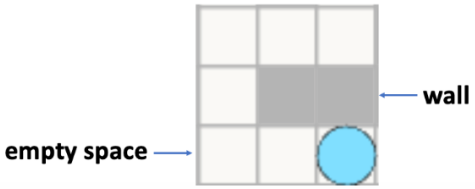
Game Basics

- This game is similar to “capture the flag”.
- The objective is for the blue robot to reach a goal location without being "tagged" by a red robot opponent within an allotted time limit of 30 timesteps.
- The game is played on a 2D grid, where positions are represented as (x, y) grid coordinates.
  - X and Y coordinates correspond to the horizontal and vertical axis, respectively.
  - Coordinates start at (0, 0) in the top left of the grid, representing x = 0 and y = 0.
- The basic components of the game board:
  - The blue robot is represented as a blue circle
    - You will control the blue robot.
    - This is the only mobile element of the game.
      - The blue robot can ONLY move 1 square in any of the cardinal directions per timestep
      - The blue robot cannot move more than 1 square per timestep
      - A timestep passes with the robot making a move in one of the cardinal directions or chosing to "stay" and hold their position for a timestep.
  - Goals are represented as green triangles
    - The blue robot must reach these locations to win the game.
    - If there are multiple goals the robot must reach ALL goals, but can do so in any order.
  - The red robot opponents are represented as red diamonds
    - The blue robot must stay at least 1 grid square away from these to win the game
    - To avoid being "tagged" by the red opponent blue must stay 1 grid square away from the 4 cardinal directions only
    - Note: The opponents are stationary. ONLY the blue robot can move in the game.



Note: the red shading is shown here for explanatory purposes and will not be shown on the game boards during the experiment.

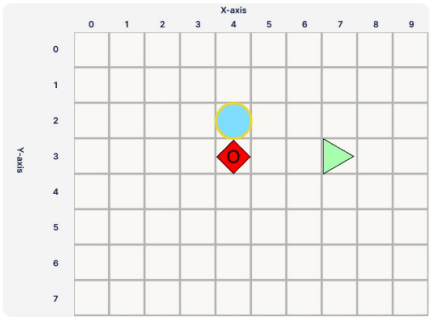
- Walls are impassable obstacles represented as gray squares
- Empty spaces where the blue robot can move to are represented as white squares

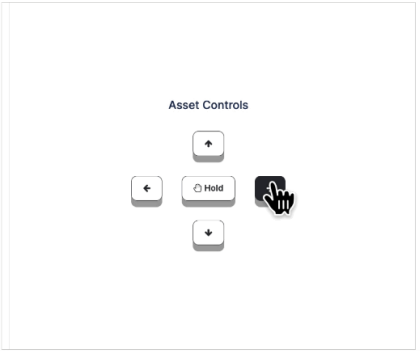


Game Introduction Webpage (**all participants**)

Game Examples

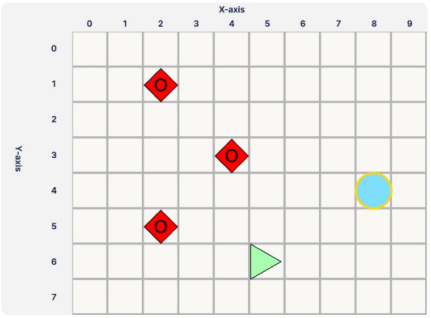
Loss via tag

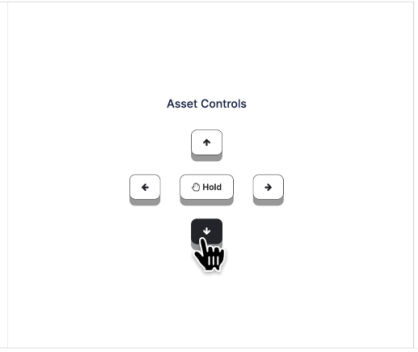


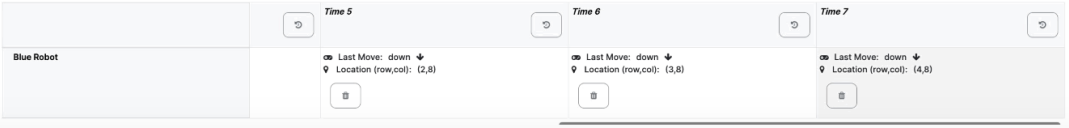


This plan results in a blue loss because the robot gets within one square of the opponent.

Loss via time

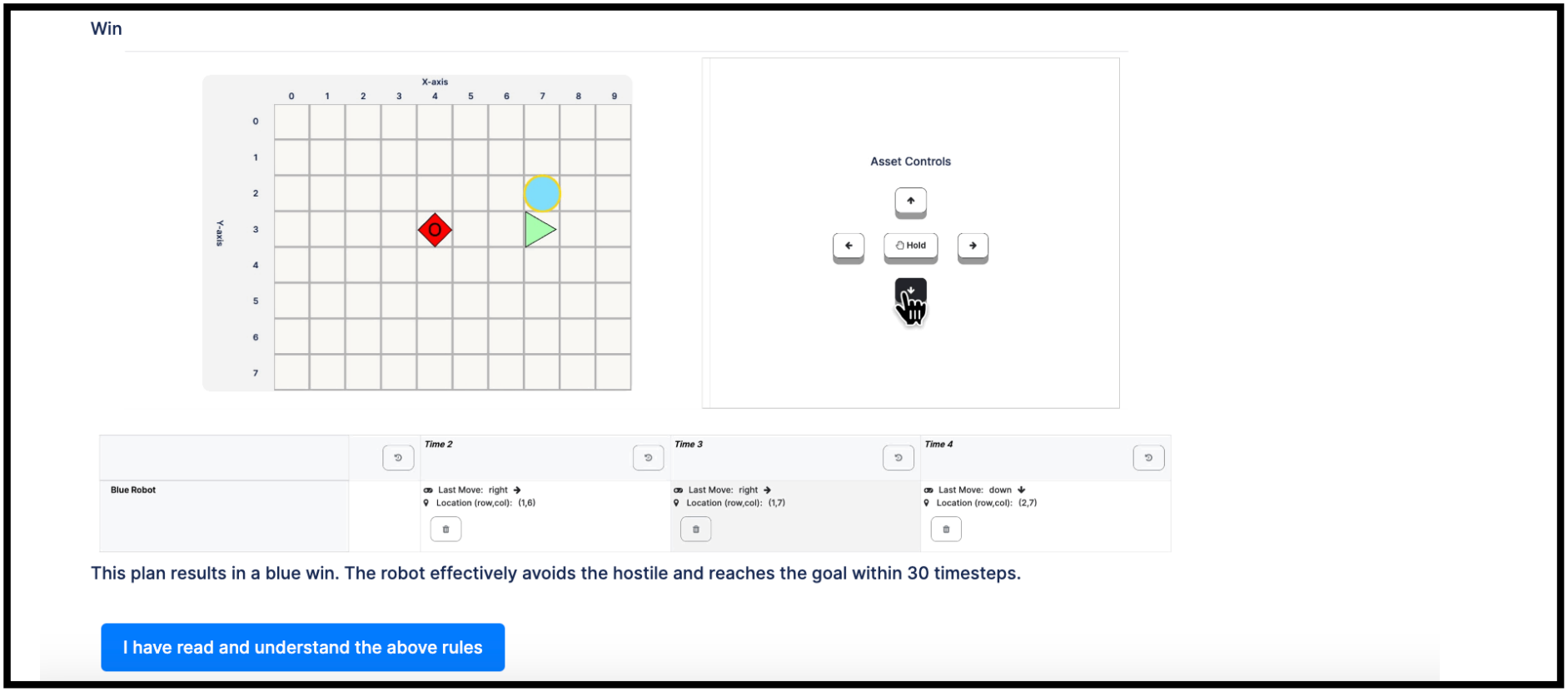






This plan results in a blue loss because the robot does NOT reach the goal within 30 timesteps.

Game Introduction Webpage (**all participants**)

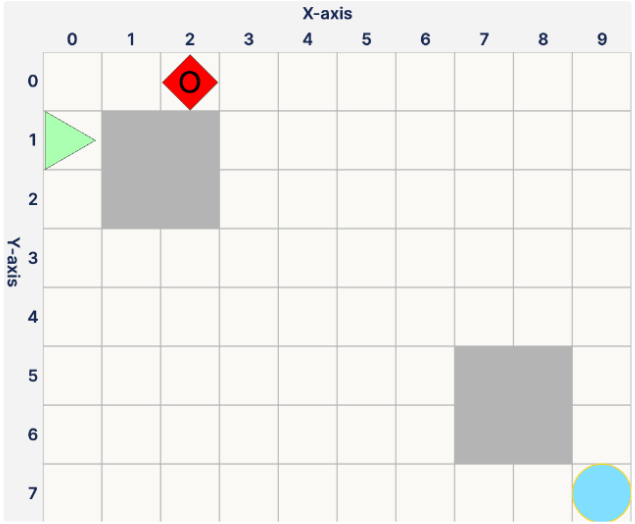


Note: Examples were displayed as GIFs. Actions were shown both actively on the game map and in a tabular format as they appear in the ManeuverGame interface.

Introduction Webpage (**all participants**)

Game Concept Check

Questions



Question 1

What is the location of the Goal? [ ]

Question 2

What is the location of the Opponent? [ ]

Question 3

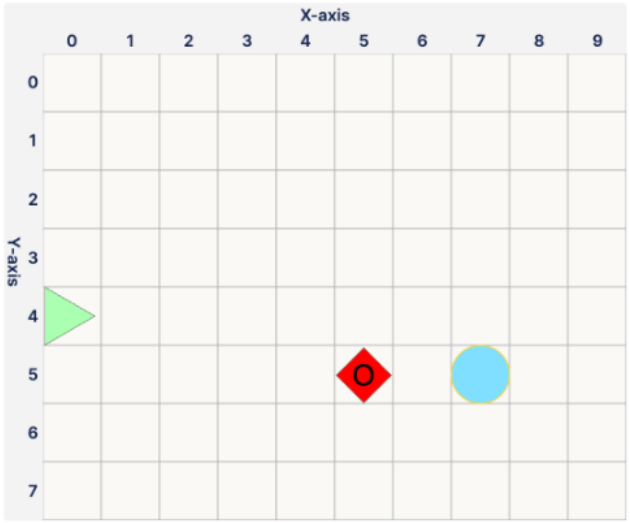
What is the location of the blue robot? [ ]

Question 4

Which action would progress the robot to [8,7]? [ ]

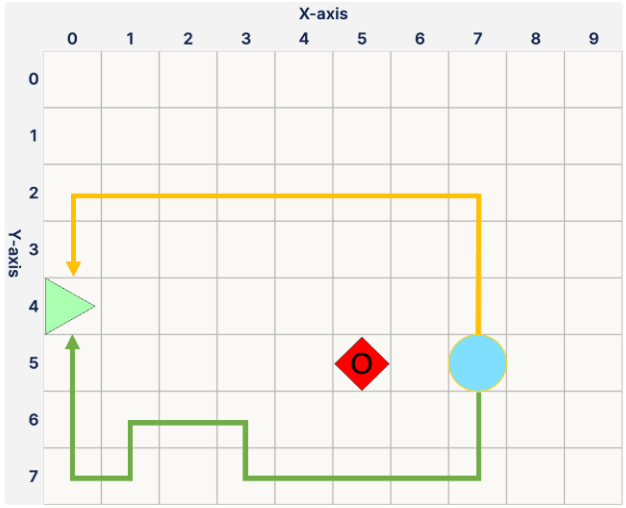
Introduction Webpage (**all participants**)

Question 5



Which action would result in the blue robot losing the game immediately?

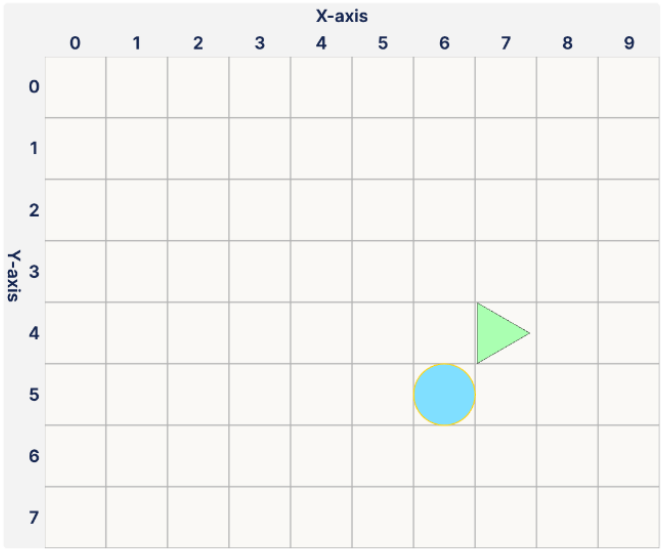
Question 6



Which of the displayed paths to the goal result in a WIN for the blue robot?

Introduction Webpage (**all participants**)

Question 7



Can the blue robot win in 1 timestep?

Submit

Note: participants must answer all the questions correctly in the introductory quizzes to be able to proceed.

Introduction Webpage (**all participants**)

SPECIFICATIONS INTRODUCTION

For the purpose of this experiment you will be examining SPECIFICATIONS.
Begin by watching these short clips to get aquainted with the basic format and function of specifications. Once you feel comfortable with these rules complete the concept check to proceed to the next introductory section.

Specification Basics

For these games you will be examining specifications for your robot. They are a set of statements that the robot must meet when making its plan for how to play the game. Specifications are described in terms of variables that are some combination of the positions of objects in the scene and the game time.

x is the x position of the blue circle (robot)
y is the y position of the blue circle (robot)

The game starts at **time 0** and the first action taken progresses the game to **time 1**.

There are also operators that work with the variables.

=	**equal to**	**x = 4**
>	**greater than**	**y > 1**
<	**less than**	**x < 9**
≥	**greater than or equal to**	**y ≥ 7**
≤	**less than or equal to**	**x ≤ 2**
OR	**logical OR** **(at least one of the conditions must be true)**	**x = 5 OR x = 1**
AND	**logical AND** **(both conditions must be true)**	**y = 2 AND x = 3**
NOT	**logical NOT** **(negates the following clause)**	**NOT (x = 5)**

Introduction Webpage (**all participants**)

The ALWAYS and EVENTUALLY operators reference timesteps of the game specifically.

ALWAYS	**ALWAYS between time 1 and time 2: S**	**the statement S must always be true for all time between time 1 and time 2**
EVENTUALLY	**EVENTUALLY between time 3 and time 10: S**	**the statement S must be true at some point in time between time 3 and time 10**

A path is considered to meet the specification if it abides by all rules of the specification. For each of the specifications you will be asked to consider all paths which meet this condition and make a determination about how this set of paths relates to game victory.

Note that plans may still be valid if they cause a player to score before the plan is complete. The player will follow the planned trajectory until it scores, and the game will end. You do not need to consider actions/consqeunces which could occur after the robot has reached all of the goals on the map.

Determination Definitions:

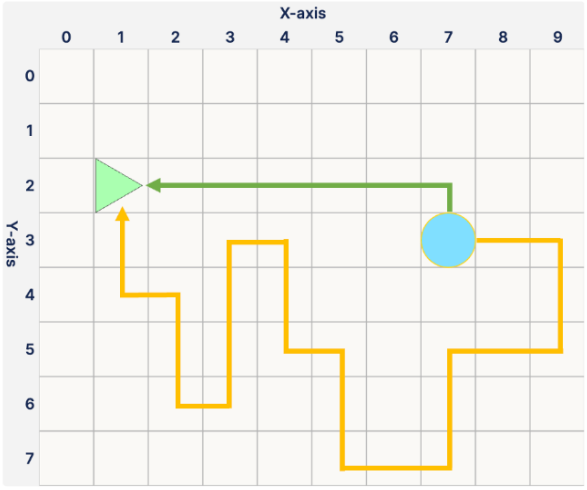
- A specification ALWAYS WINS if and only if
  1) EVERY plan that follows it results in the blue robot WINNING in that scenario.
- A specification is SOMETIMES LOSES for a given scenario if
  1) It cannot be completed given the game rules
  2) It allows plans that fully meet its requirements but EITHER
     - fails to allow the blue robot to score in 30 timesteps
     - allow the blue robot to be tagged by a hostile

For the sake of this experiment: There will always be at least 1 plan POSSIBLE following the specification on the given map, even though such a plan may result in the robot losing the game.

Introduction Webpage (**all participants**)

Specification Concept Check

For Questions 1 and 2 consider the following map with two separate WINNING paths displayed in yellow and green.



Question 1

Say that we have the Specification

```
from time 7 to 30 EVENTUALLY
  x = 1
  AND
  y = 2
```

The green and orange paths are two different paths that the blue robot could take which satisfy the specification above TRUE or FALSE?. [ ]

Question 2

Now say that we use a slightly different specification:

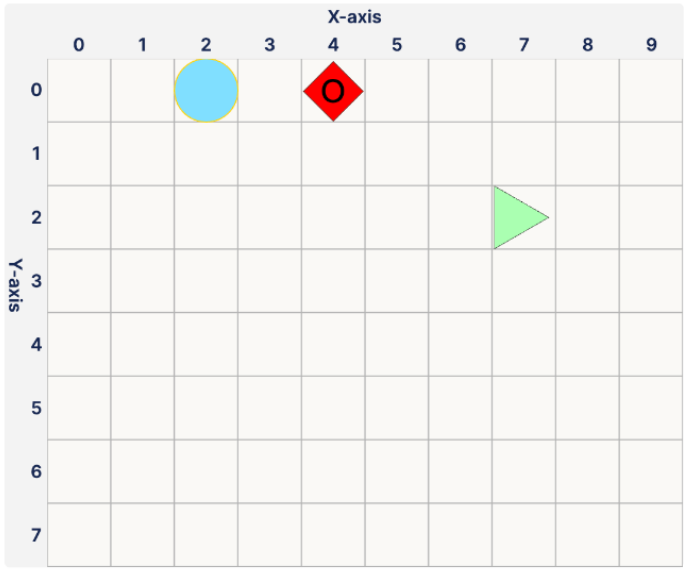
```
from time 7 to 30 EVENTUALLY
  x = 1
  AND
  y = 2
AND
from time 0 to 4 ALWAYS
  x ≥ 7
```

Which of the paths above meets this new specification? [ ]

Introduction Webpage (all participants)

Question 3

Consider the following specification



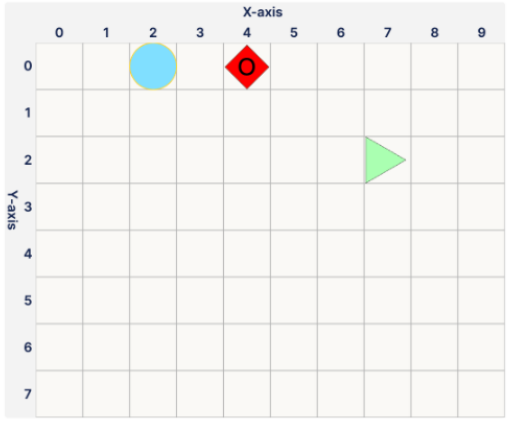
from time 0 to 3 EVENTUALLY x = 2
AND
from time 0 to 3 EVENTUALLY y ≥ 2
AND
from time 3 to 30 ALWAYS y > 1
AND
from time 3 to 30 EVENTUALLY
  x = 7
  AND
  y = 2

Which statement is correct?

Introduction Webpage (**all participants**)

Question 4

Consider this following updated specification

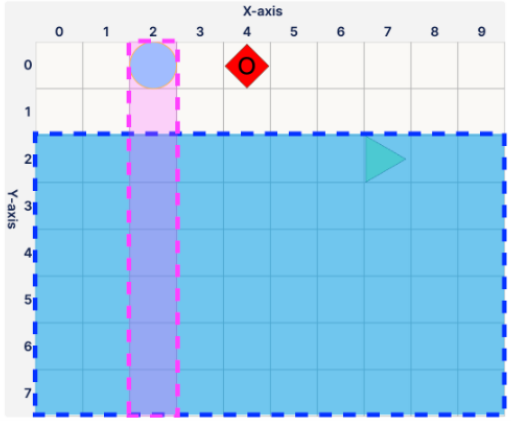


from time 0 to 3 ALWAYS x = 2
AND
from time 0 to 3 EVENTUALLY y > 2
AND
from time 3 to 30 ALWAYS y > 1
AND
from time 3 to 30 EVENTUALLY
x = 7
AND
y = 2

Now, which statement is correct?

B) The specification ALWAYS WINS because a winning plan can be generated following this specification

The correct answer is A becuase the first 2 statements requires the robot stay in the pink region and navigate down to y > 2. Then, the subsequent statement makes the blue robot stay within blue region for all timesteps 0 to 30 thus eliminating the threat of the opponent tagging, and the final statement requires thay the blue robot reach the goal within 30 timesteps.



Submit

Note: Questions must eventually be answered correctly on the webpage in order for participants to proceed. Feedback describes the correct answer and the reasoning behind that answer on incorrect selections and re-selection can be made as many times as necessary.

Introduction Webpage (**control**)

Concept Check Complete!

You have completed your first set of introductory tasks. You are moving on to a more integrated introductory section.
In the next section you will be working through questions on the experiment game interface with some helpful hints.
For this section will be presented with 4 scenarios with a map + specification pair.

Your Task:

You will be making a determination about if these specifications will cause a robot to ALWAYS WIN or SOMETIMES LOSE for the given map scenario.
There will always be at least one plan possible with the given map and specification pair (the robot will be able to make some path to meet all of the rules of the specification, though that path might result in game loss)
The robot will NOT start in a position that violates the specification
There will be at least 3 possible plans for all ALWAYS WINS specifications and at least 1 possible plan for all SOMETIMES LOSES specifications
Note: the possible plans you consider do not need to occupy the whole 30 timesteps unless you are thinking that the robot cannot reach the goal within 30 timesteps.

For each of the introductory scenarios in this section you will be provided a hint to help in making your determination and thinking through possible plans.
Such hints will not be provided once you begin the experiment.
If you have any questions about the experiment or game interface please ask the experiment supervisor before you proceed.

Introduction Webpage (**AL-WF and AL-NF**)

Concept Check Complete!

You have completed your first set of introductory tasks. You are moving on to a more integrated introductory section.
In the next section you will be working through questions on the experiment game interface with some helpful hints.
For this section will be presented with 4 scenarios with a map + specification pair.

Your Task:

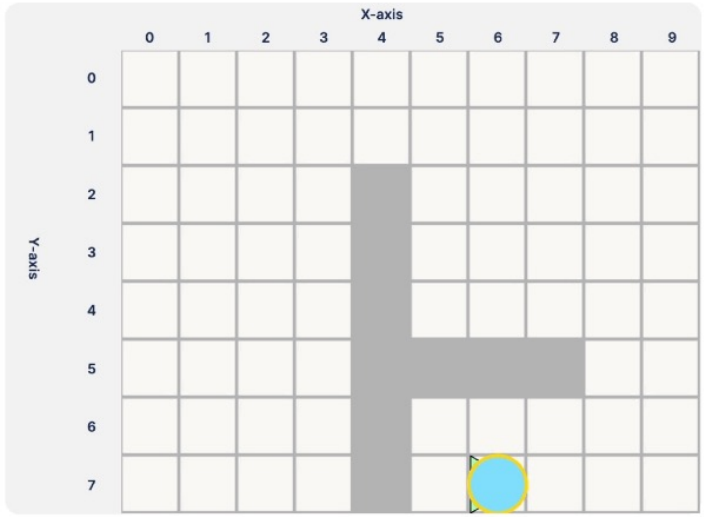
You will be making a determination about if these specifications will cause a robot to ALWAYS WIN or SOMETIMES LOSE for the given map scenario.
You will be asked to "show your work" in making this determination by provividing plans (series of robot actions) which meet the specification and show the robot winning or losing the game.

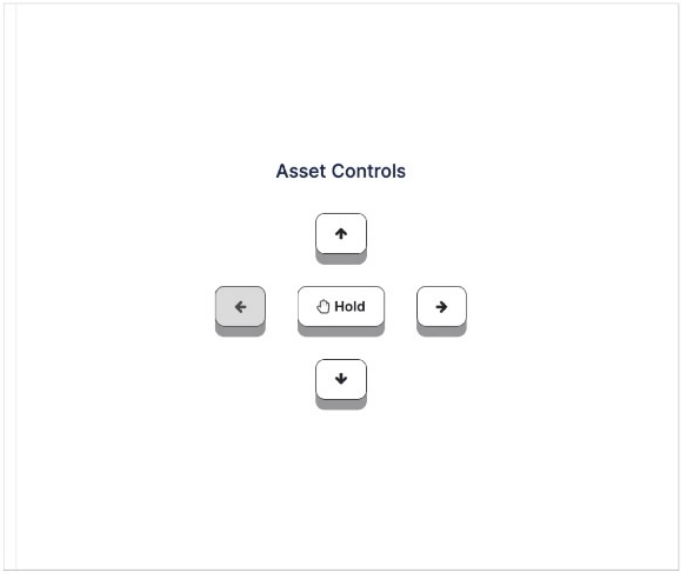
- to make the ALWAYS WINS determination we ask that you provide 3 winning plans.
- to make the SOMETIMES LOSES determination we ask that you provide 1 losing plan.
- Note: your plans do not need to occupy the whole 30 timesteps unless you are illustrating that the robot cannot reach the goal within 30 timesteps.

For each of the introductory scenarios in this section you will be provided a hint to help in making your determination and crafting your plans.
Such hints will not be provided once you begin the experiment.
following clips to gain farmilarity with the interface before you begin.

Game Examples

Example 1: Movement



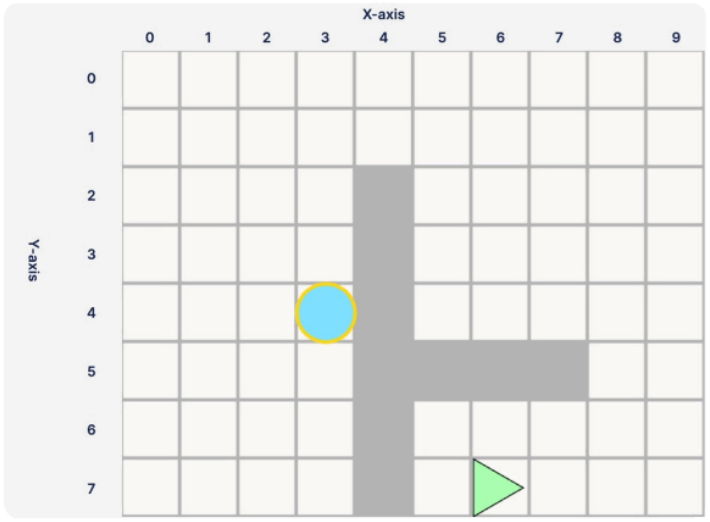


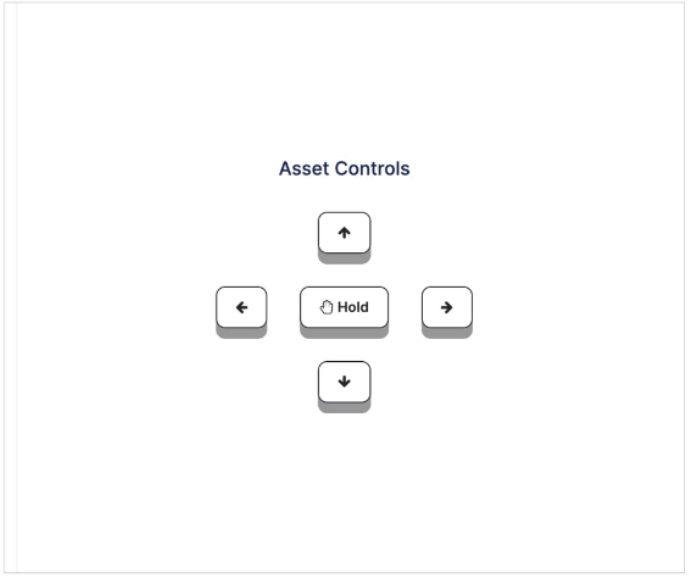
You will use the Asset Control buttons to move the blue robot around the board and have it play the game

Note: Examples were displayed as GIFs. Actions were shown both actively on the game map and in a tabular format as they appear in the ManeuverGame interface.

Introduction Webpage (**AL-WF and AL-NF**)

Example 2: Invalid Movement (Into walls)



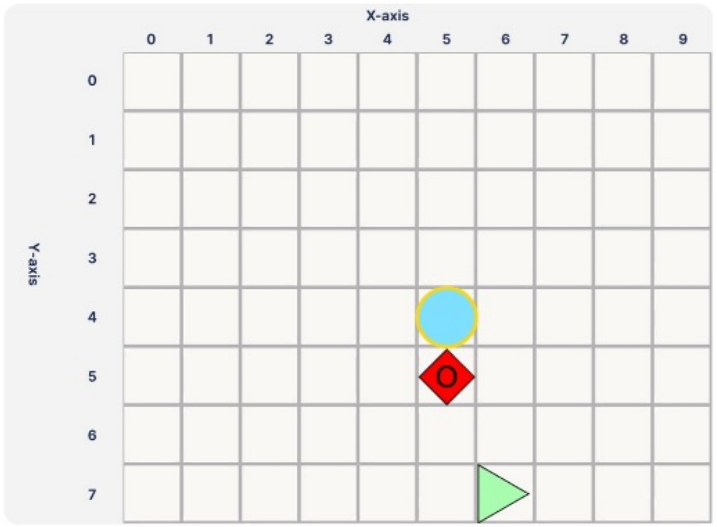


		Time 3	Time 4	Time 5
Blue Robot		Last Move: up Location (row,col): (4,2)	Last Move: hold Location (row,col): (4,2)	Last Move: right Location (row,col): (4,3)

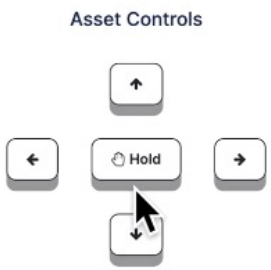
You cannot move the robot into walls. This action will be invalid and a system message will appear to let you know. Attempting invalid actions will NOT take up a timestep.
Note: The timesteps and each action taken will be displayed at the bottom of the page.

Introduction Webpage (**AL-WF and AL-NF**)

Example 3: Invalid Movement (Into hostile)



No-Op: existing asset at target location



		Time 1	Time 2	Time 3
Blue Robot		Last Move: right → Location (row,col): (4,3)	Last Move: right → Location (row,col): (4,4)	Last Move: right → Location (row,col): (4,5)

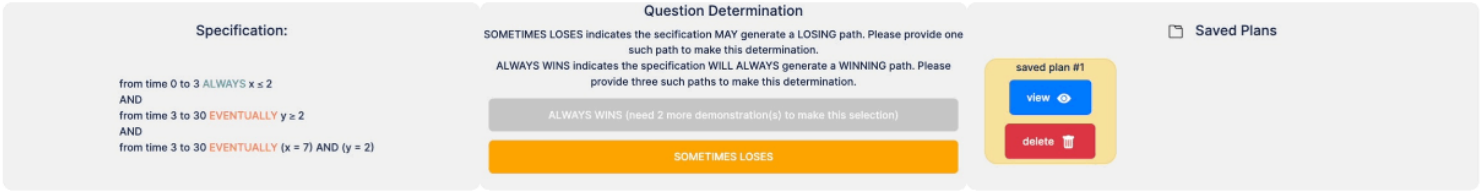
You cannot move the robot into a hostile. This action will be invalid and a system message will appear to let you know. Attempting invalid actions will NOT take up a timestep

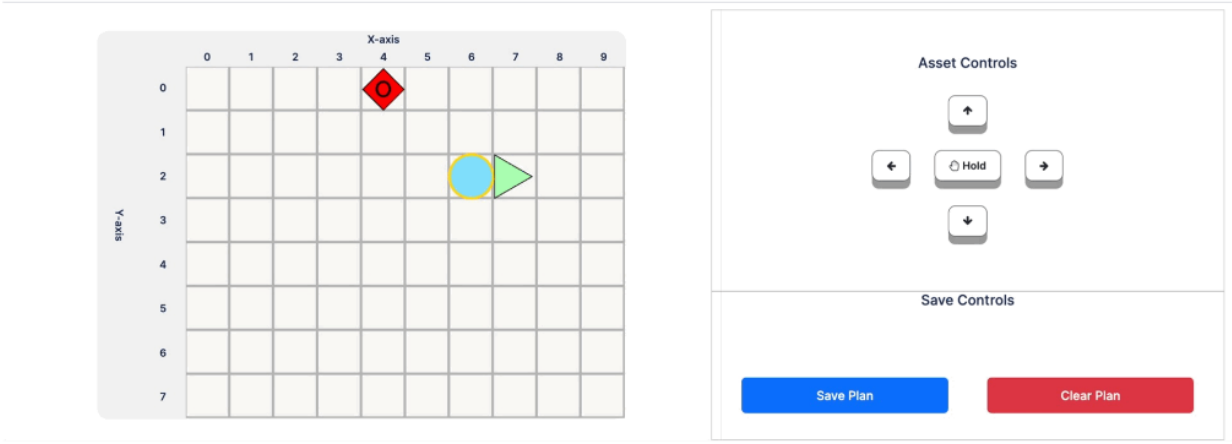
Note: If the robot is within range to take this invalid action it has automatically lost the game becuase being one step away from a hostile results in a "tag" per game rules.

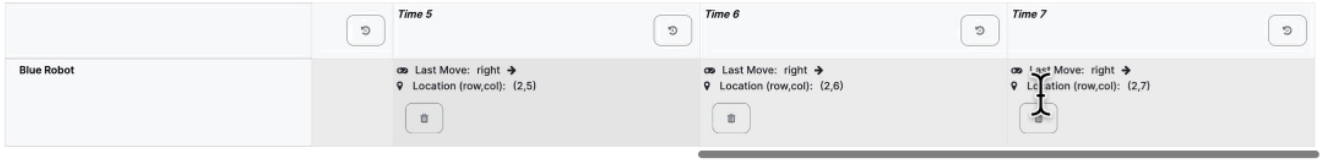
Introduction Webpage (**AL-WF**)

Saving Examples

Example 4: Saving Plan







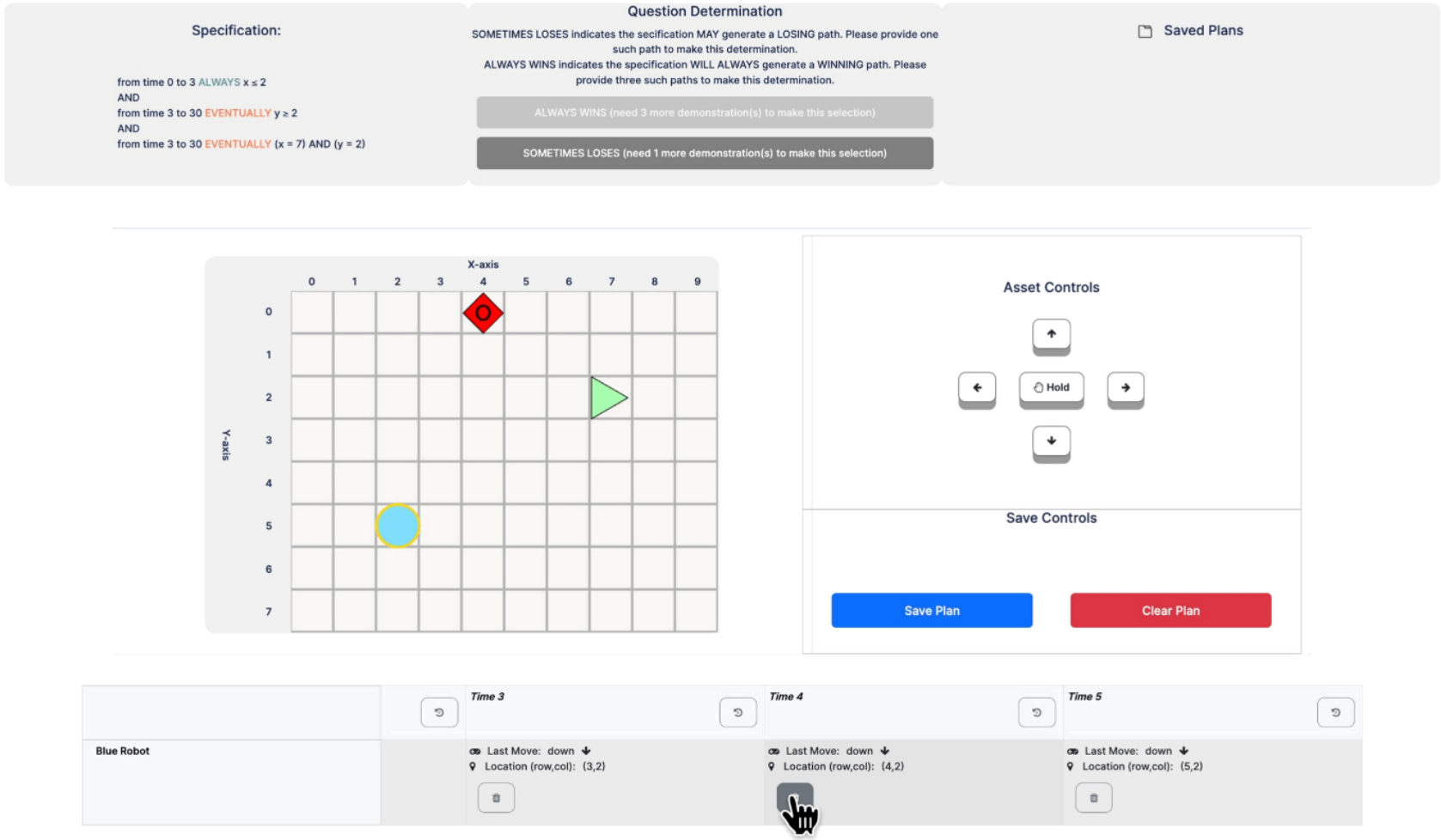
Once you have created a plan which meets the specification save it for submission using the save plan button. Once a plan is saved it will be accessible to view or delete under the saved plans tab. To view each step of the plan use the return button for the step you would like to view in the bottom actions bar.

All the plans you save are required to meet the specification for the given scenario. Once you click save plan your plan will be checked and will not be saved if it violates the rules of the specification.

Note: this line is omitted for the **AL-WF** condition

Introduction Webpage (**AL-WF and AL-NF**)

Example 5: Editing Current Plan

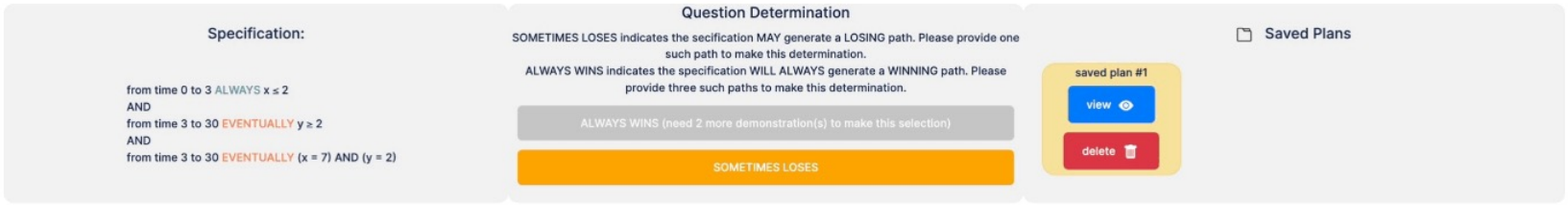


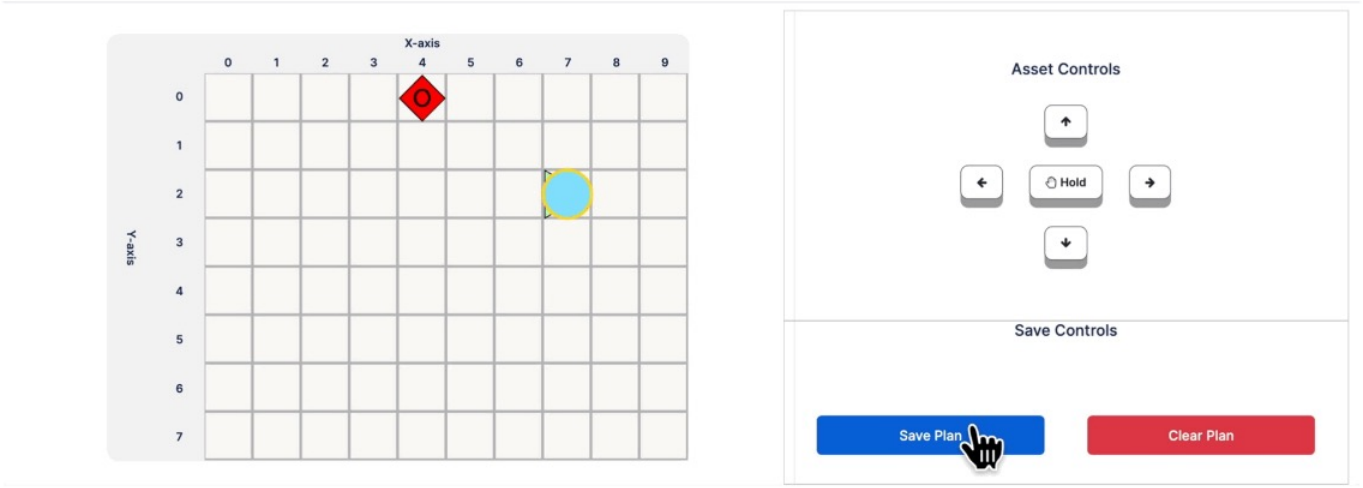
Timesteps/actions in the current plan can be removed using the trash icon 🗑 in the actions bar at the bottom of the page. Note: deleting an action will remove all subequent actions in a plan.

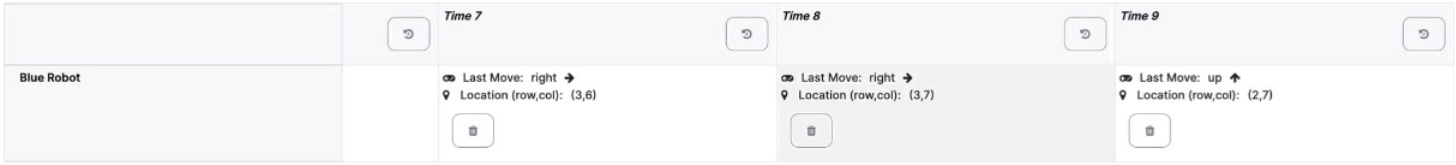
Introduction Webpage (**AL-WF and AL-NF**)

Example 6: Making Determination

The clip below shows a user saving 3 winning plans and making the determination that the robot ALWAYS wins







You will not be able to make your determination and the determination buttons (SOMETIMES LOSES/ALWAYS WINS) will remain inactive until you have provided a sufficent number of plans to make that determination.
The determination buttons will indicate the number of plans needed to make that determination.

Introduction Webpage (**control**)

Question 1 out of 4 introductory questions

Example 1

Hint: This is a ALWAYS WINS specification.

Possible Paths include:
- Navigating straight down to the goal
- Navigating up first and then straight down to the goal
- Taking two steps down and one step up all the down to the goal.

Specification:

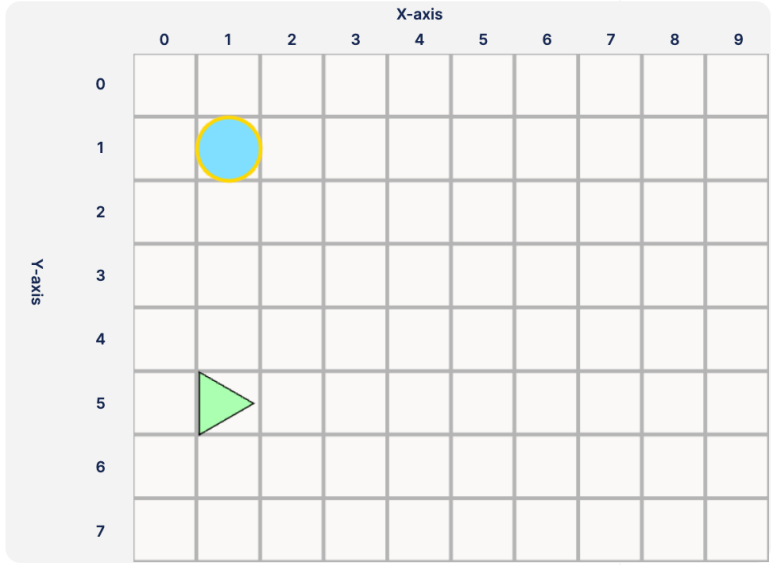
from time 0 to 30 ALWAYS x = 1
AND
from time 0 to 30 EVENTUALLY y = 5

Question Determination

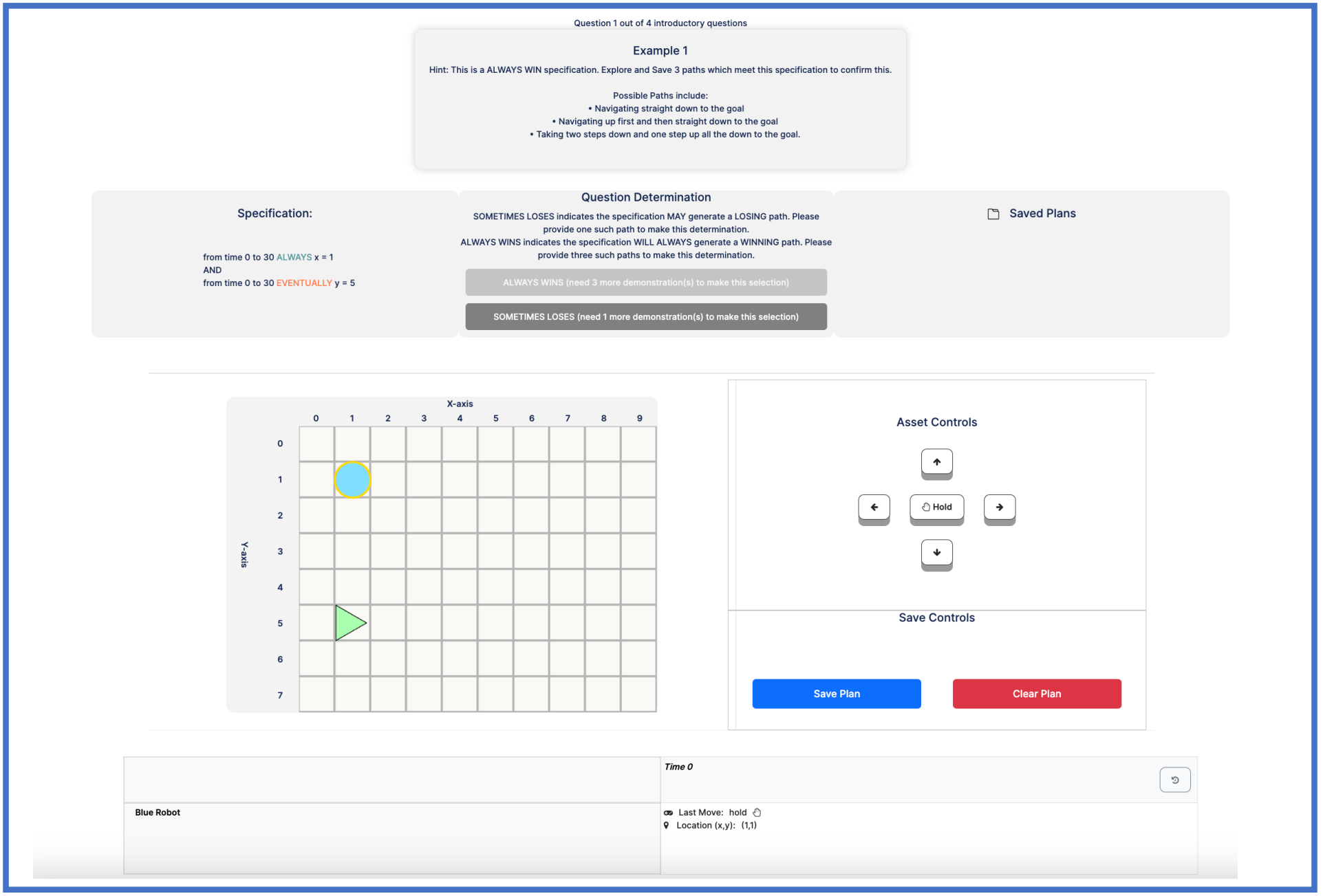
SOMETIMES LOSES indicates the specification MAY generate a LOSING path.
ALWAYS WINS indicates the specification WILL ALWAYS generate a WINNING path.

ALWAYS WINS

SOMETIMES LOSES



Introduction Webpage (**AL-WF and AL-NF**)



Introduction Webpage (**control**)

Question 2 out of 4 introductory questions

Example 2

Hint: This is a ALWAYS WINS specification. Its possible for the robot to navigate to the goal with at least 3 different paths. Think through this specification and select the "ALWAYS WINS" button to indicate that the specification ALWAYS WINS.

Specification:

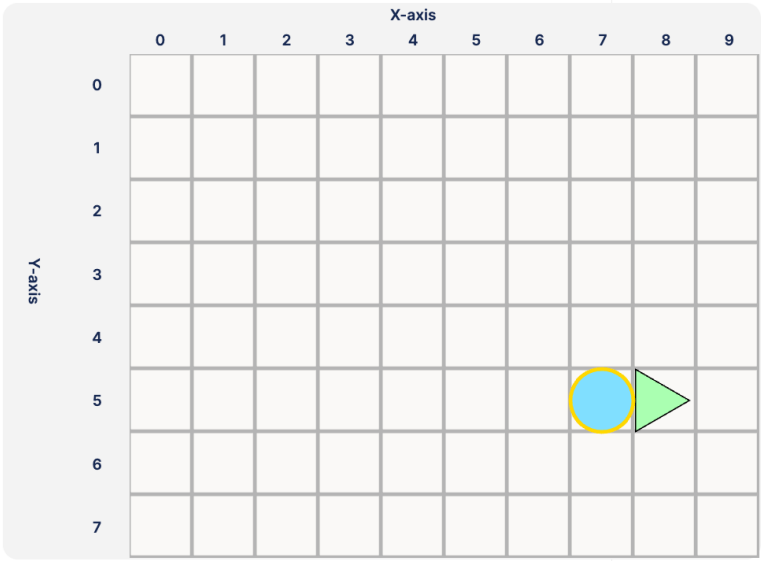
from time 0 to 30 EVENTUALLY (x = 8) AND (y = 5)

Question Determination

SOMETIMES LOSES indicates the specification MAY generate a LOSING path.
ALWAYS WINS indicates the specification WILL ALWAYS generate a WINNING path.

ALWAYS WINS

SOMETIMES LOSES



Introduction Webpage (**AL-WF and AL-NF**)

Question 2 out of 4 introductory questions

Example 2

Hint: This is a ALWAYS WIN specification. Navigate to the green goal via three different paths. Be sure to save your plan after each time you reach the goal.
Use the saved plan tiles to view the trajectories you created. Once you have all 3 use the "ALWAYS WINS" button to indicate that the specification ALWAYS WINS and submit your trajectories.

Specification:

from time 0 to 30 EVENTUALLY (x = 8) AND (y = 5)

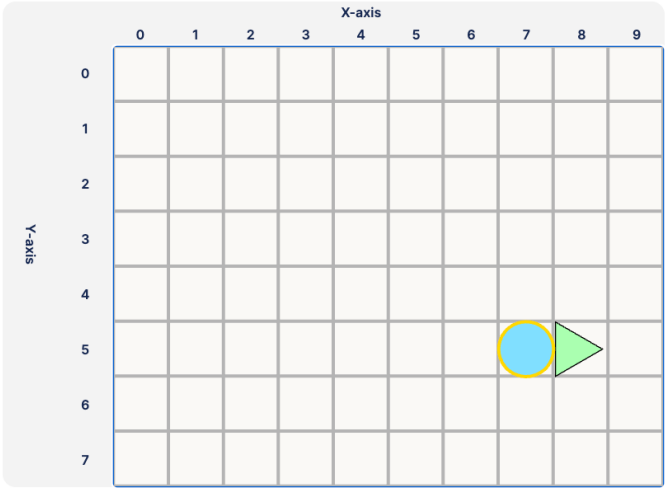
Question Determination

SOMETIMES LOSES indicates the specification MAY generate a LOSING path. Please provide one such path to make this determination.
ALWAYS WINS indicates the specification WILL ALWAYS generate a WINNING path. Please provide three such paths to make this determination.

ALWAYS WINS (need 3 more demonstration(s) to make this selection)

SOMETIMES LOSES (need 1 more demonstration(s) to make this selection)

Saved Plans



Asset Controls

Hold

Save Controls

Save Plan

Clear Plan

Time 0

Blue Robot

Last Move: hold
Location (x,y): (7,5)

Introduction Webpage (**control**)

Question 3 out of 4 introductory questions

Example 3

Hint: This is a SOMETIMES LOSES specification. Think through a plan which follows the specification, but results in the robot being tagged by a hostile to support this evaluation. Then select the SOMETIMES LOSES button.

Specification:

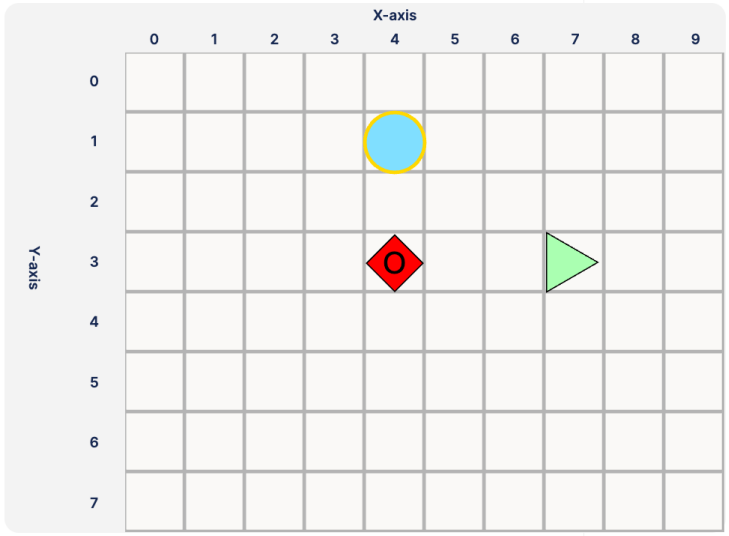
from time 5 to 30 ALWAYS x = 7
AND
from time 5 to 30 EVENTUALLY y = 3

Question Determination

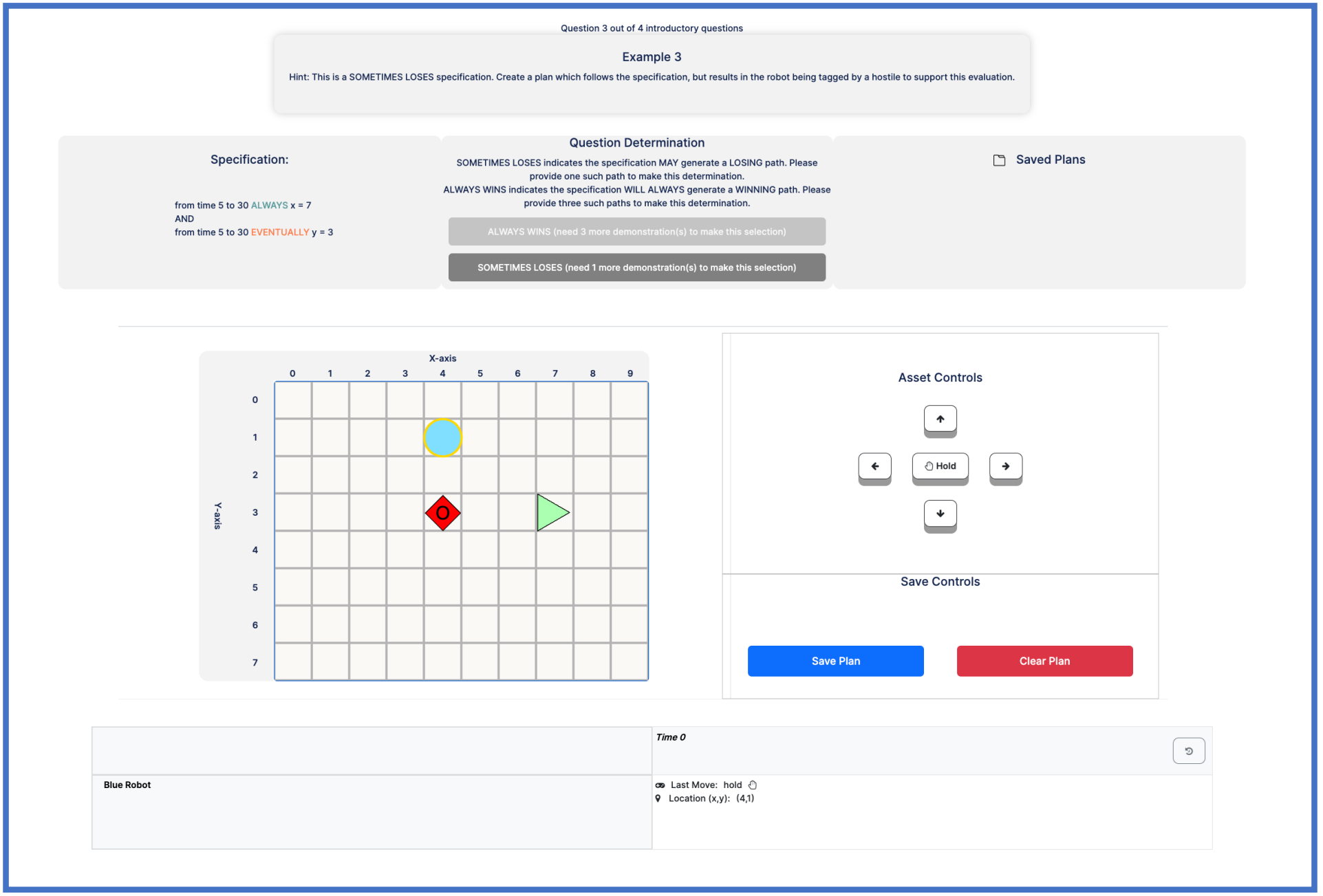
SOMETIMES LOSES indicates the specification MAY generate a LOSING path.
ALWAYS WINS indicates the specification WILL ALWAYS generate a WINNING path.

ALWAYS WINS

SOMETIMES LOSES



Introduction Webpage (**AL-WF and AL-NF**)



Introduction Webpage (**control**)

Question 4 out of 4 introductory questions

Example 4

Explore this specification on your own and make your determination. This is a good opportunity to think through the dynamics of the game a bit before moving onto the next step.

Specification:

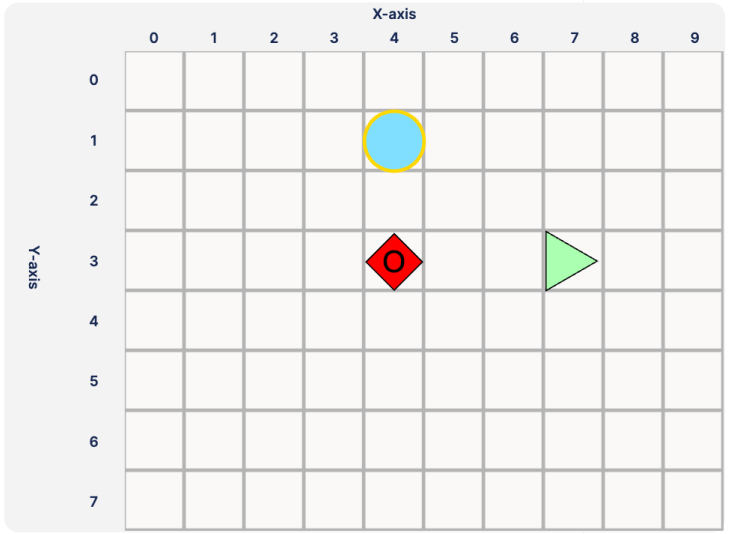
from time 0 to 10 ALWAYS x > 2
AND
from time 0 to 10 ALWAYS y < 3
AND
from time 0 to 30 EVENTUALLY x = 7

Question Determination

SOMETIMES LOSES indicates the specification MAY generate a LOSING path.
ALWAYS WINS indicates the specification WILL ALWAYS generate a WINNING path.

ALWAYS WINS

SOMETIMES LOSES



Introduction Webpage (**AL-WF and AL-NF**)

Question 4 out of 4 introductory questions

Example 4

Explore this specification on your own and make your determination. This is a good opportunity to explore the dynamics of the game and interface a bit before moving onto the next step. Note: Remember you can view and delete plans using the top right bar.

Specification:

from time 0 to 10 ALWAYS x > 2
AND
from time 0 to 10 ALWAYS y < 3
AND
from time 0 to 30 EVENTUALLY x = 7

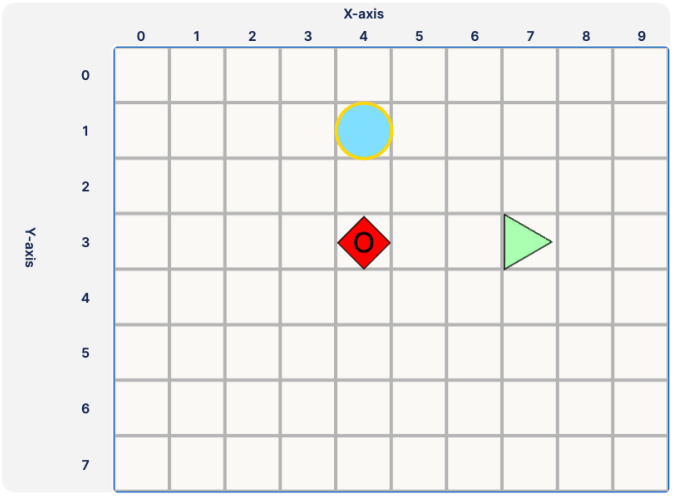
Question Determination

SOMETIMES LOSES indicates the specification MAY generate a LOSING path. Please provide one such path to make this determination.
ALWAYS WINS indicates the specification WILL ALWAYS generate a WINNING path. Please provide three such paths to make this determination.

ALWAYS WINS (need 3 more demonstration(s) to make this selection)

SOMETIMES LOSES (need 1 more demonstration(s) to make this selection)

Saved Plans



Asset Controls

Hold

Save Controls

Save Plan

Clear Plan

Time 0

Blue Robot

Last Move: hold
Location (x,y): (4,1)

Introduction Webpage (All Conditions)

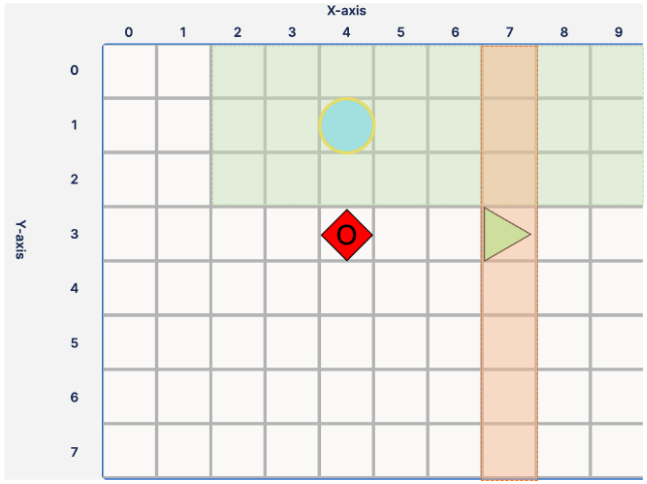
Answer/Explaination:

The correct determination was that the specification SOMETIMES LOSES.

Specification:

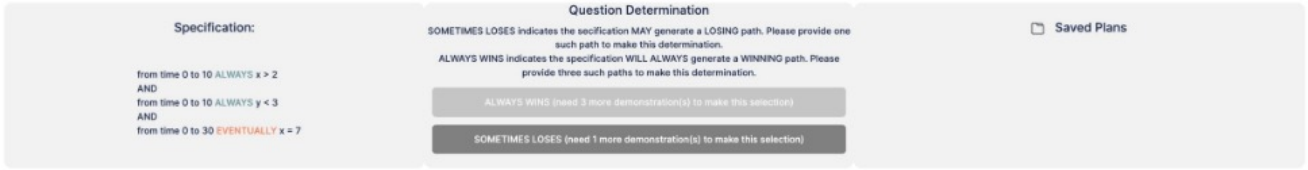
from time 0 to 10 ALWAYS x > 2
AND
from time 0 to 10 ALWAYS y < 3
AND
from time 0 to 30 EVENTUALLY x = 7

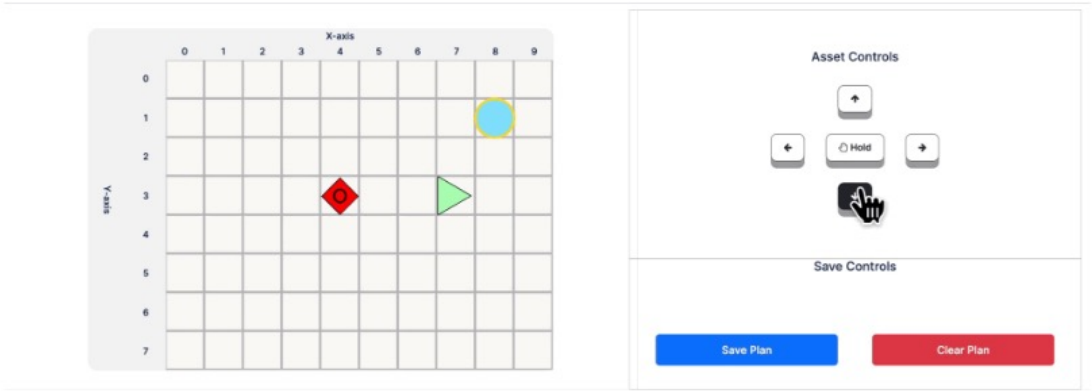
The first two statements require that the robot stay in the green region from 0-10. The third statment requires that the robot enters the orange region at some point between 0 and 30. Thus, the robot can lose the game in numerous ways while following this specification. The gifs below depict a couple of examples of how this could occur.

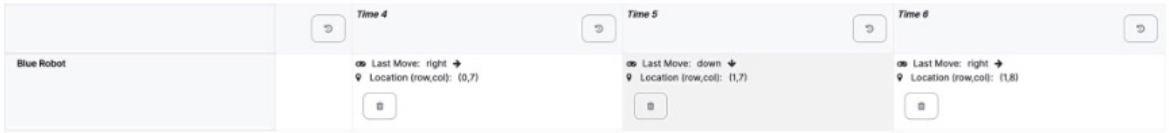


Introduction Webpage (All Conditions)

The robot can lose by getting tagged by the robot anytime 10 to 30.

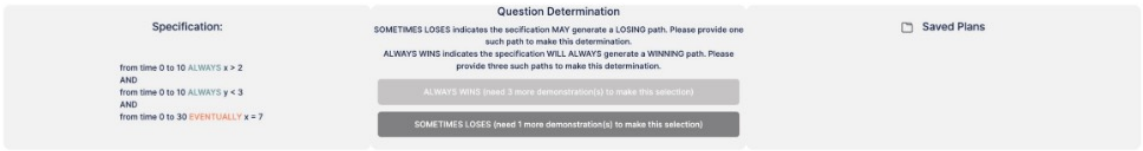


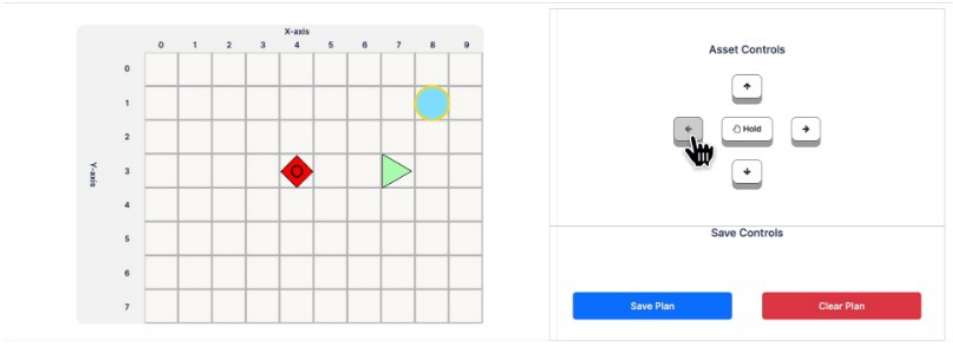




Introduction Webpage (All Conditions)

The robot can also lose by never reaching the goal in 30 timesteps.





Introductory Tasks Complete!

You have now completed all the introductory tasks and are moving on to the experiment questions.
You will be presented with 10 scenarios with a map + specification pair.
You will be asked to provide plans which meet the specification and determine if the specification causes the robot to ALWAYS WIN or SOMETIMES LOSE.
After each question you will be asked to rate your confidence in your submission.

If you have any questions about the experiment or game interface please ask the experiment supervisor before you proceed.

Note: this line about plan generation is omitted from the materials for the **control** condition

Introductory Content 3: Talk Aloud Prompts

These are the prompts read aloud and given on paper to participants of the 'talk-aloud' group.

For this experiment, we would like you to talk out loud as you think through the problems to help us understand how you are working through them.

As you talk out loud, consider the following:

- What factors are you considering when making your validity determination?
- We want to know about aspects of the interface that help in making their determination
- What, if any, strategies are you using to develop your trajectories?

As you wrap up the experiment:

- Explain how you went through the questions of the experiment to someone else
- What aspects of the interface were most helpful to you?
- What aspects of the interface were least helpful to you?
- Did you have any realizations during any part of the experiment?
- Provide any general open-ended comments