A1 - CS4300 Lab Report

1. Introduction

The core of the Wumpus World program is a 2-by-2 grid containing pits, a single piece of gold, and an agent. In this case, the grid will always have a consistent layout, with pits at (1, 3), (2, 4), (3, 2), and (4, 2) and the gold at (2, 2) in x-y coordinates. The agent's goal in this case is to walk over the gold and avoid falling in pits, and it can either rotate left 90 degrees, rotate right 90 degrees, or move forward one cell. Our agent for this experiment starts at (1, 1) facing right and will just randomly choose one of these three actions each step for a maximum of 50 steps. The issues to address are:

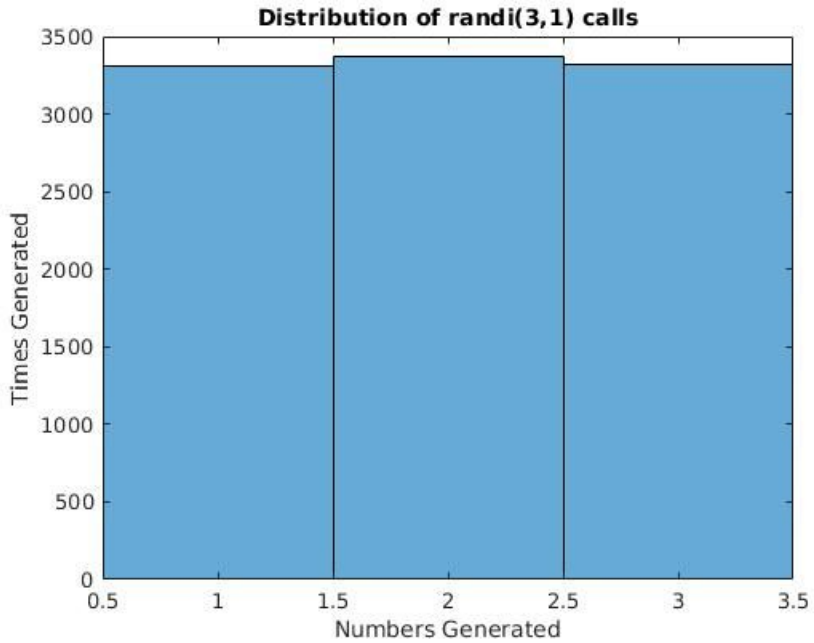
- On average, how many steps will the agent survive and how often does it find the gold?
- How does varying the maximum number of steps affect these values?

2. Method

The method used in the program randomly generates a number between 1 and 3, and then returns that number as an action. The program then runs through max values starting at the value of 5 to 100 incrementing by 5 each time. For each of the max values the method is tested 2000 times and then the mean, variance and confidence interval of the max steps taken and if the gold is obtained is recorded. In order to store the number of steps and whether or not the gold is obtained a vector is used to store the results for each trail. To calculate the mean variance and the confidence interval the function mean, var, and paramci are used, which are all functions in Matlab.

3. Verification of Program

A randi(3,1) is used to generate a random a random integer between 1 and 3. To verify that this is uniformly distributed, the same call was run 10000 times to produce this histogram:



The numbers were all verified to be either 1, 2, or 3 with:
>> a = find(samps ~= 3 & samps ~= 2 & samps ~= 1)
a =
  1×0 empty double row vector

The agent method was temporarily tweaked so it only chooses to move forward, so it should have moved to the right and then got stuck on the wall for the rest of the steps, never reaching the gold:

results_step_mean = 50
results_step_variance = 0
results_gold_mean = 0

The agent's start position was then set to (1, 2) so it would touch the gold and then fall into a pit having lived 2 steps:

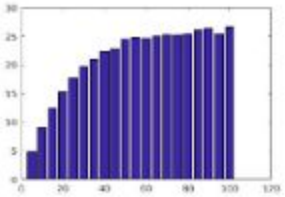
results_step_mean = 2
results_step_variance = 0
results_gold_mean = 1

The agent's start position was then set to (1, 4), so it would fall into a pit after the first step:
results_step_mean = 1
results_step_variance = 0
results_gold_mean = 0

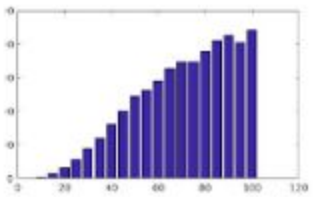
4. Data and Analysis

Below is a table of the data collected for a variety of max step values, and below that are bar graphs of each row with with x-axis reflecting the the max steps and the y-axis reflecting the the results of that data.

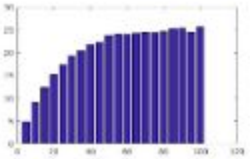
max steps	steps mean	steps variance	steps ci low	steps ci high	gold aquired mean	gold aquired ci low	gold aquired ci high
5	4.8915	0.19282	4.8722	4.9108	0.0435	0.034553	0.052447
10	9.0695	3.8576	8.9834	9.1556	0.143	0.12764	0.15836
15	12.507	14.859	12.338	12.676	0.2015	0.18391	0.21909
20	15.414	32.52	15.164	15.664	0.267	0.2476	0.2864
25	17.735	57.366	17.402	18.067	0.303	0.28284	0.32316
30	19.752	88.934	19.338	20.165	0.299	0.27892	0.31908
35	21.015	120.57	20.533	21.497	0.3495	0.32859	0.37041
40	22.459	161.36	21.901	23.016	0.3395	0.31873	0.36027
45	22.815	200.01	22.195	23.435	0.3505	0.32957	0.37143
50	24.573	244.59	23.887	25.259	0.3755	0.35426	0.39674
55	24.856	263.98	24.144	25.568	0.392	0.37059	0.41341
60	24.677	289.8	23.93	25.423	0.3745	0.35327	0.39573
65	25.095	327.5	24.301	25.889	0.3865	0.36514	0.40786
70	25.368	346.29	24.552	26.184	0.393	0.37158	0.41442
75	25.245	345.87	24.429	26.061	0.404	0.38248	0.42552
80	25.504	380.27	24.649	26.359	0.3905	0.3691	0.4119
85	26.226	412.2	25.336	27.116	0.3995	0.37802	0.42098
90	26.369	425.73	25.464	27.273	0.3775	0.35624	0.39876
95	25.5	405.98	24.617	26.384	0.3805	0.3592	0.4018
100	26.652	439.9	25.733	27.572	0.3795	0.35821	0.40079



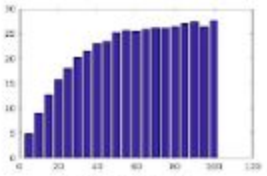
Steps Mean



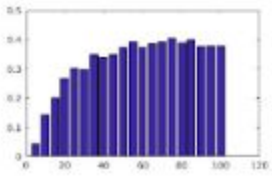
Steps Variance



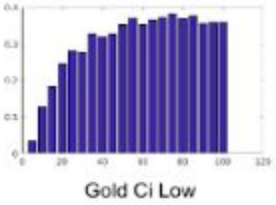
Steps Ci Low



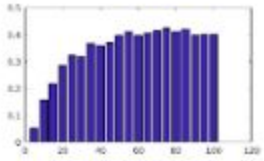
Steps Ci High



Gold Acquired Percentage



Gold Ci Low



Gold Ci High

As the number of steps increase

- The steps mean increase and levels off at around 26
- The steps variance continuously increases
- The steps ci low increases and levels off at around 25
- The steps ci high increases and levels off around 27
- The gold acquired percentage increases and levels off around .38
- The gold ci low increases and levels off around .36
- The gold ci high increases and levels off around .40

5. Interpretation

The mean steps taken increases very rapidly when the max steps is small, but this growth diminishes substantially and eventually seems to settle at around 26 steps. This is because the agent stops acting when it hits a pit, and a large maximum number of steps will increase the odds that of touching any cell simply because it has more opportunities to do so. This means that increasing the maximum steps will affect the mean less and less because the agent is most likely already dead by the time it reaches a high step count. The same principle also holds true for the fraction of times the agent touched the gold, which appears to settle around 0.38.

6. Critique

In the graphs the overall trend seems to be that the data levels off once it reaches a certain point. One possible issue with our technique is cutting off the max steps at 100. One way that the program could be improved is by increasing the max value that the max number of steps could be. By increasing that value it could help either reinforce our finding by continuing any trends that we discovered, or it could in fact show different results as the values continue to increase.

7. Log

Cam:

- Learning Matlab and implementing code: 3 hours
- Writing report and doing verification: 2.5 hours

William Garnes:

- Approximately 7 hours was spent learning matlab, implementing the code, and writing this report