CARLETON UNIVERSITY
SCHOOL OF COMPUTER SCIENCE
COMP 4106 (Winter 2020)

ARTIFICIAL INTELLIGENCE
NEWS

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January 6, 2020
1. Classes start.
2. TA timings will soon be included in the Course outline.
3. Hope you all enjoy the course!

January 7, 2020
1. Christopher Blackman's office hours have been changed to Friday, 14:00 to 16:00 hours.

January 14, 2020
1. Will the PMC students and student with S. No. 100962777 please meet me in my room after class today? Otherwise, please send me an e-mail ASAP. Many thanks.

January 20, 2020
1. The TA Office Hours for the course will be held in Room 4125. The timings have not changed.

January 27, 2020
1. Due to an out-of-campus appointment, I will not be holding Office Hours today.

February 4, 2020
1. Two students have shown me a demo of their BFS and DFS for Assignment 1. So the "Coffee Challenge" has been won. Congrats to them both.

February 9, 2020
1. The link for the time slots for Assignment 1 is: https://docs.google.com/spreadsheets/d/1b5IGNX6q1u8LR3wxSWo03aBePspdQS84cOGx679NhHI/edit#gid=0
2. It should be publicly visible to all, but not editable to anyone but the TAs.
3. Please email Christopher (ChristopherBlackman@cmail.carleton.ca) for the slots you want - as your three preferences. He will *not* respond to the emails directly as that would be very time consuming. Rather, he will just add them to the sheet. The student will then be able to view this update and ensure they do have a confirmed slot.

February 11, 2020
1. The link for the time slots for the Project Proposal is: https://docs.google.com/spreadsheets/d/1TsS7zyJ2zdb2mWVgc9KnilPDNnmB2S8hduVDOOEdnSA/edit?usp=sharing
2. It should be publicly visible to all, but not editable to anyone but the TAs.
3. Please email Jacob (JacobBoertjes@cmail.carleton.ca) for the slots you want - as your three preferences. He will *not* respond to the emails directly as that would be very time consuming. Rather, he will just add them to the sheet. The student will then be able to view this update and ensure they do have a confirmed slot

February 14, 2020
1. The link for the time slots for Assignment 2 is:
2. https://docs.google.com/spreadsheets/d/1l6IYoHgggUypzH584RE-VeC8HzJMMxB2JAmIZBnh4I8/edit?usp=sharing
3. It should be publicly visible to all, but not editable to anyone but the TAs.
4. Please email Tim (TimPatton@cmail.carleton.ca) for the slots you want - as your three preferences. He will *not* respond to the emails directly as that would be very time consuming. Rather, he will just add them to the sheet. The student will then be able to view this update and ensure they do have a confirmed slot.
5. Have a good Winter Break, everyone. You deserve it!

February 20, 2020
Here is the grading "mechanism" for Assignment 1 for COMP 4106 (Winter 2020):

Cat-Mouse problem (100 marks)
- Can the Cat-Mouse problem be solved by using BFS? (10%)
- Can the Cat-Mouse problem be solved by using DFS? (10%)
- Can the Cat-Mouse problem be solved by using A* (20%: 10% for one heuristic, 10% for second and average)
- Does the student's report sufficiently discuss the state space and heuristics (20%)
- Can the student meaningfully discuss why the searches perform as they do during the demo, and their heuristics? (15%)
- Can the student logically show which search algorithm is better? (10%)
- Can the student evaluate well the combination of the two heuristic? (10%)
- Can the student give a proposal for making the Mouse move faster, and the board size increasing? I have not required this in the assignment, but you can ask them these. (5%)

BONUS:
- Can the student solve the general Bonus part(s) as described in the bonus question? (+5%)

February 26, 2020
1. There will be a lecture on Natural Language Processing (NLP) on March 23, 2020. It will be given by my ex-PhD student, Dr. Spencer Polk.
2. There will be a lecture on Swarm Intelligence (SI) on March 25, 2020. It will be given by my ex-MCS student, Mr. Petro Verkhogliad.
3. No one must miss these lectures as you will be tested on these materials in the Final Exam.

March 4, 2020
1. The **revised** link for the time slots for Assignment 2 is:
2. https://docs.google.com/spreadsheets/d/1nMNWGzKD1dwpXBuGznUlzxksP1QyHPzSeFZWouSbHX8/edit?usp=sharing
3. It should be publicly visible to all, but not editable to anyone but the TAs.
4. Please email Tim (TimPatton@cmail.carleton.ca) for the slots you want - as your three preferences. He will *not* respond to the emails directly as that would be very time consuming. Rather, he will just add them to the sheet. The student will then be able to view this update and ensure they do have a confirmed slot.
5. Have a good Winter Break, everyone. You deserve it!

March 6-7, 2020
1. The marks for Assignment 1 have been uploaded.
2. Assignment 3 has been posted. The lectures on RL will start on Monday, March 9, 2020.

March 14, 2020: Post A

Due to the extra-ordinary measures taken by the Government and the University, the procedures and protocols for the course have been changed. The University, the School and I, thank you for working with me to coordinate the course at this difficult time.

Please read the following very carefully. ***Each one is responsible to ensure that they do their share***.

The remainder of the course will proceed as follows:

1. To avoid "large gatherings", ***there will be NO Final Exam for the course***. The weight assigned to the Final Project will be increased so as to include the weight previously assigned to the Final Exam.
2. The lectures for the material that I am going to teach will be uploaded periodically. So, please keep abreast with the updates in this file. Please note that as there is no Final Exam, I will only be teaching you the material needed for Assignment 3.
3. Here are the Skype IDs of the TAs:
   Timothy Patton: live:.cid.8b1e7e35b5c7832a
   Christopher Blackman: live:.cid.386d53fc9444c5ae
   Geetika Sharma: geetika.shrma16
   Jacob Boertjes: caioop4 (name set to Jacob Boertjes)
   Yunkai Wang: live:.cid.487a80e9f669a3db
4. All Office Hours and demos (one-on-one) will, in future, ***be held on Skype***. Please make sure that you a good set-up, where you can also show your screen (with the program running), to the TA. Please note that this is your responsibility, and I request you to be proactive and not wait for the demo time to see whether it works or not.
5. Please arrange with the respective TA for the time, and then things will move smoothly. We will accommodate reasonable delays and hiccups in the process.
6. All questions sent to me by e-mail will be answered in the News file. I myself will not be working via Skype, but will respond, wherever possible, by e-mail, and if necessary, by phone.
7. We will soon post the dates for the demos of Assignment 3, and later the dates for the demos of the Final Project.

March 14, 2020: Post B

1. It has come to my attention that not all students are able to use Skype. In this applies to you, please contact your TA and see if he or she can work on Discord. Here are their Discord coordinates:
   Timothy Patton: pattontim#8110
   Christopher Blackman: tyuijhgs#5867
   Geetika Sharma: geetika#2609
   Jacob Boertjes: GorgeousBoertjes#0074 (Updated on March 16. 2020)
   Yunkai Wang: Yunkai#3311
2. A brief summary of the notes on LA has been uploaded in the file BriefSummaryLA.pdf. I will say more about it in a short personal video which I will upload later this weekend.

March 16, 2020: Post A

1. The above-mentioned personal video is uploaded as FinalTalkLA.mp4. I believe that I have covered everything that you need to know for the assignment.
2. I sincerely hope that everything is clear. I will answer other questions as another item. Please do the best that you can. I will also be considerate when we grade the assignment.

The following are some questions that have been raised about Assignment 3, and here are the corresponding answers:

Q1: How is time measured?

A1: Time is measured by events. One event would include all of the following

1. If the elevator is on floor 'i', the waiting time is f_i. A request is made by a person (e.g., enter on floor 2, exit on floor 4).
2. The elevator takes the person to the floor they requested, and finally chooses to rest on one of the K floors.
3. This means that the destination does not really matter in calculating the optimal floor to wait on.
4. The cost of this decision would be the amount of time the elevator has to wait on that floor.
5. Since we want the overall error to be low, and the elevator's choice should eventually converge to always wait on the same floor 'j' for which the f_j is minimum.

Q2: Is it fair to assume that the elevator completes a request before moving on to the next request?

A2: Yes. Only one person requests an elevator at a time (only one event at a time).

Q3: The description mentions two matrices, E and L. Do we use the same equation f_i to calculate the probability for both entering and exiting the elevator?

A3: You do not need to worry about E and L. f_i is the amount of time the elevator must wait at floor 'i' before attending to the next request. Eventually, you will want to wait at the floor with the minimum waiting time.

Q4: Is the random variable h calculated for each floor once at the beginning, and does it then remains constant for each floor for the rest of the simulation?

A4: No. Rather, h is calculated for each new event. It provides a noise component to change the waiting time for every event.

Q5: Do we randomly decide which floor the new request comes from?

A5: Yes. You are free do it with any assumption you want. Just state the assumption when you program the solution and do the demo.

Q6: What do we do for multi-action LA?

A6A: For FSSA, the principle is the same as in the 2-action case. Let me explain for the Tsetlin case. On getting a Reward, we go into the most internal state, one step at a time. On getting a Penalty, unlearn one step at a time, and switch states to the next action (in a cyclic manner) at the central states. *I have included a figure about this on the next page*.

A6B: For VSSA, it is as explained in the notes. You choose the actions based on an action probability vector P(n), whose components are $[p_1(n), p_2(n), \dots p_R(n)]^T$. Then, if any action α_i is chosen and rewarded by the Environment, the probabilities of all the other actions are decreased linearly, and $p_i(n)$ is increased to yield $p_i(n+1)$.
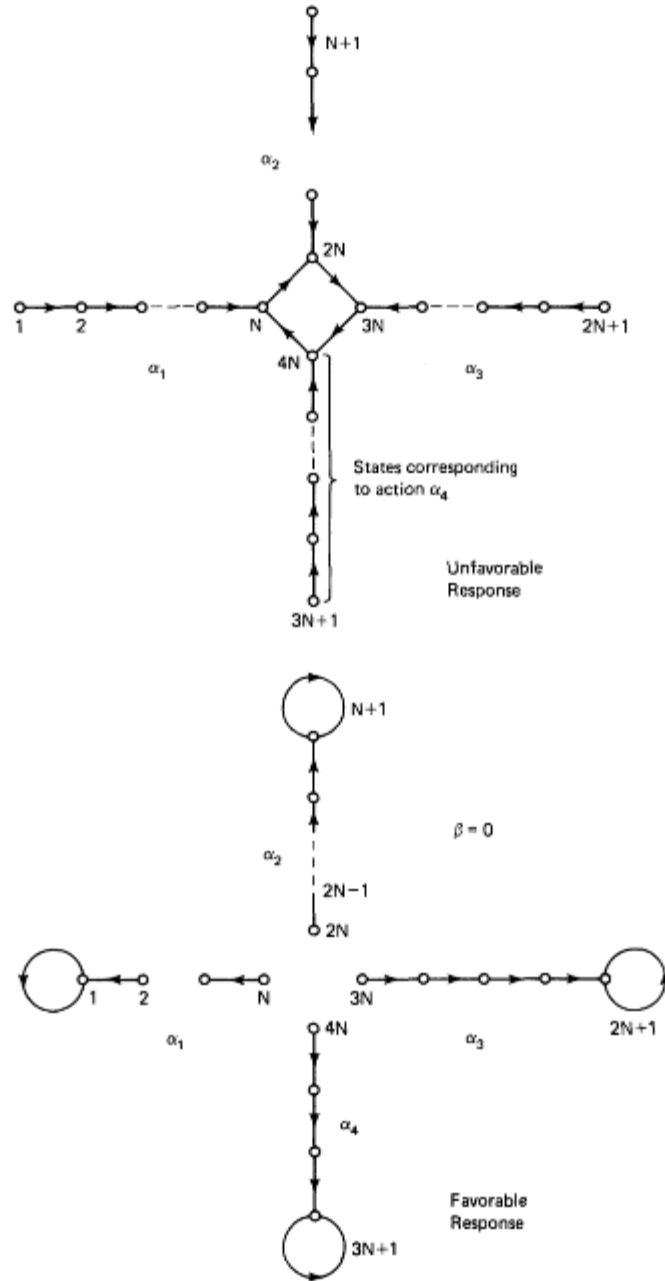
Figure 3.17: The $L_{KN,K}$ automaton $(K = 4)$ (*Courtesy Academic Press*).

March 17, 2020
1. Overall marking scheme of the course has been changed due to COVID-19.
2. There will be 3 assignments, equally weighted, and totaling *75%* of the final credit.
3. There will be 1 final project carrying *25%* of the final credit.
4. There will NOT be a final exam due to COVID-19. The changed marking scheme is in red.
5. All of this is given in the uploaded document 4106Outline20Mod.pdf.

March 24, 2020: Post A
1. The link for the time slots for Assignment 3 is:
2. https://docs.google.com/spreadsheets/d/1Tpc-WdUTROQ-d2r21r_o_BcZiVjBBVDLcwKvGs3Gr1o/edit?usp=sharing
3. It should be publicly visible to all, but not editable to anyone but the TAs.
4. Please email Geetika (GeetikaSharma@cmail.carleton.ca) for the slots you want - as your three preferences. She will *not* respond to the emails directly as that would be very time consuming. Rather, she will just add them to the sheet. The student will then be able to view this update and ensure they do have a confirmed slot.

March 24, 2020: Post B
1. The marks for Assignment 2 and the Project Proposal have been uploaded.
2. It appears as if the Project Proposal for some students was not *Acceptable*. As a special case, because of these special COVID-19 situations, we allow you to submit whatever you are able to, and you will be graded accordingly depending on what the project is and how much work it has involved. Obviously, you will not get the same credit as those whose Project Proposal was *Acceptable*, and whose Project involved much more work.

March 24, 2020: Post C
1. Assignment 3 has been marginally modified to reflect the report you are to write. The change is in red.
2. The link for the time slots for the Final Project is:
https://docs.google.com/spreadsheets/d/1FQeumTgHPkGey-uXD3qF_SICkxTIoc1GXgI7_KGsDEY/edit?usp=sharing
3. It should be publicly visible to all, but not editable to anyone but the TAs.
4. Please email Yunkai (YunkaiWang@cmail.carleton.ca) for the slots you want - as your three preferences. He will *not* respond to the emails directly as that would be very time consuming. Rather, he will just add them to the sheet. The student will then be able to view this update and ensure they do have a confirmed slot.
5. The other change was with regard to the function G(.) in the assignment. This is not the Output function of the LA. To avoid confusion, I have changed it to Q(.), and is in red.

March 26, 2020: Post A
1. There have been some questions about the speed and accuracy of LA. I have explained it in the notes, but I'll explain it again here, specifically, for the elevator problem. Let us suppose that the optimal action is to stop at Floor 3. In a single experiment, there is a transient phase during which the machine is learning. One cannot exactly determine the duration of the transient phase, but you are free to choose any timeframe you want, for example, 10,000 events. This means that after 10,000 events, you have assumed that the learning algorithm has converged. To determine the accuracy, we consider how many times it has converged to Floor 3 after this transient phase. For example, consider the time between events 10,001 and 11,000. If, in this timeframe, the elevator has waited at the optimal floor 680 times, we can evaluate the accuracy as 0.68.

Obviously, this will change experiment by experiment, and so we usually do an *ensemble* of experiments, for example, 100 experiments. I want you to report the average accuracy over the 100 experiments.

With regards to speed, you will see that the accuracy of being at floor 3 is initially 1/6 (because this is uniformly chosen and because there are six floors). If you record the accuracy continuously over the ensemble of 100 experiments, for example, every 50 steps, you will notice that this average accuracy increases from 1/6 to the final accuracy; to 0.68, in this example. What I want you to report is how long it takes for the system to converge to 90% of the terminal accuracy.

I thought I had explained it in the notes, but I hope that this present explanation is clear enough. In any case, do the best you can, and we will be lenient in our grading.

2. There was a typo in the notation (see Item 5 in yesterday's last post). I have also corrected this in red in the assignment.

April 7, 2020
1. The marks for Assignment 3 have been uploaded.

April 22, 2020
1. The marks for the Final Project have been uploaded.
2. The grades will be submitted to the Dean before the weekend.
3. I want to sincerely thank everyone for this very interesting course. I did the best I could considering the dire situations. In spite of COVID-19, I thank you for working together with the TAs and me.
4. All the best for your futures, and keep healthy everyone!