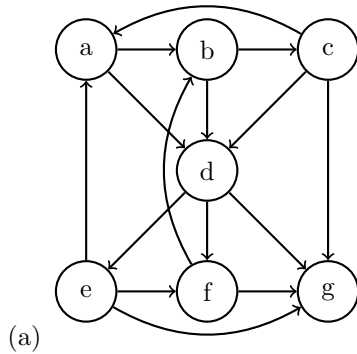


# COMP4418, 2017 – Assignment 3

Due: Wednesday, 22 November, 23:59:59

Worth: 15%

1. [20 Marks] (Social Choice and Game Theory)



In the tournament in the above Figure, assuming all the arcs missing from the figure are downward arc, list

- the uncovered set;
- the top cycle;
- the set of Copeland winners;
- the set of Banks winners; and
- the set of Condorcet winners.

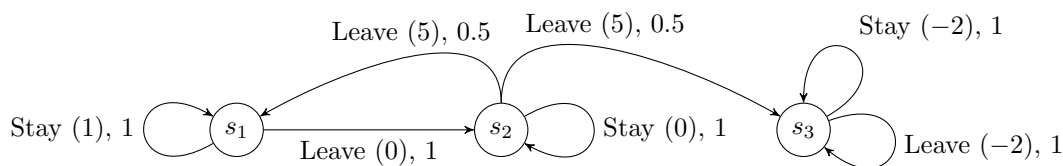
(b) Compute all the Nash equilibria of the following two player game.

	D	E
A	2, 4	8, 5
B	6, 6	4, 4

2. [30 Marks] (Decision Making)

- (a) For each of the following games, choose the best model among **(A)** Markov chain (Markov process); **(B)** Markov decision process (MDP); **(C)** Hidden Markov model (HMM); **(D)** Partially-observable Markov decision process (POMDP); and **(E)** None/Other.
- Blackjack
  - Candy Crush
  - Chess
  - Minesweeper
  - Snakes and Ladders
  - Texas Hold 'em Poker

For the next questions, consider the Markov Decision Process depicted below. Edges are labelled “name of the action (reward associated), probability of the transition”.



- (b) Using your intuition, give an optimal policy for situations where the discount factor is very high (for instance,  $\delta = 0.999$ )? Explain your reasoning in two or three sentences.
- (c) Using your intuition, give an optimal policy for situations where the discount factor is very low (for instance,  $\delta = 0.001$ )? Explain your reasoning in two or three sentences.
- (d) Represent the values computed during the first three iterations of the Value Iteration algorithm using the following format where  $L$  represents the action *Leave* and  $S$  represents the action *Stay*. Use a discounting factor of 0.6.

	$V_0(s)$	$V_0(s, S)$	$V_0(s, L)$	$V_1(s)$	$V_1(s, S)$	$V_1(s, L)$	$V_2(s)$	$V_2(s, S)$	$V_2(s, L)$	$V_3(s)$
$s_1$	0	1	...							
$s_2$	0	...								
$s_3$	0									

- (e) Let  $\pi$  be the following policy:  $\pi(s_1) = L$ ,  $\pi(s_2) = L$ ,  $\pi(s_3) = S$ . If  $\pi$  is assumed to hold, the MDP turns into a Markov Chain. Represent this Markov Chain / Markov Process.
- (f) Assuming the agent uses  $\pi$ , express the value associated to each state as a function of the discount factor  $\delta$ . Provide the formal derivation of the result as part of your answer. Elaborate on whether the computations of this question support the intuition of questions 2b and 2c.

## Submission

- Put your written solutions in a single PDF file `assn3.pdf`
- Submit using the command: `give cs4418 assn3 assn3.pdf`

## Late Submissions

Due to the assignment due date being extended to the 22nd November there will be no late submissions allowed.

## Academic Honesty and Plagiarism

All work submitted for assessment **must be your own work**. Assignments **must be completed individually**. We regard copying of assignments, in whole or part, as a very serious offence. Be warned that:

- the submission of work derived from another person, or jointly written with someone else will, at the very least, result in automatic failure for COMP4418 with a mark of zero;
- allowing another student to copy from you will, at the very least, result in a mark of zero for your own assignment; and
- severe or second offences will result in automatic failure, exclusion from the University, and possibly other academic discipline.

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