COMP4418, 2017 – Assignment 3

Z5045582

Yunhe Zhang

1. Social Choice and Game Theory

(a)

the domination set of each alternative
a {b, d, f, g}
b {c, d, e, g}
c {a, d, e, f, g}
d {e, f, g}
e {a, f, g}
f {b, g}
g {}

- **the uncovered set:**

Alternative in two steps:
a {b, c, d, e, f, g} ✓
b {a, c, d, e, f, g} ✓
c {a, b, d, e, f, g} ✓
d {a, b, e, f, g} ×
e {a, b, d, f, g} ×
f {b, c, d, e, g} ×
g {} ×

The uncovered set is **{a, b, c}**

- **the top cycle:**

The top cycle is **{a, b, c, d, e, f}**

- **the set of Copeland winners:**

the set of Copeland winners is **{c}**

- **the set of Banks winners:**

maximal acyclic subgraph length is 5
b ⇨ c ⇨ d ⇨ e ⇨ g
c ⇨ a ⇨ d ⇨ f ⇨ g
the set of Banks winners is **{b, c}**

- **the set of Condorcet winners:**

no alternative is satisfied, so the set of Condorcet winners is {}

(b)
Pure Nash equilibria
(A, E)
(B, D)

Mixed Nash equilibria
Player 1 plays A with p, plays B with 1 – p
$4p + 6(1 - p) = 5p + 4(1 - p)$
$4p + 6 - 6p = 5p + 4 - 4p$
$3p = 2$
$p = 2 / 3$

Player 2 plays D with q, plays E with 1 – q
$2q + 8(1 - q) = 6q + 4(1 - q)$
$2q + 8 - 8q = 6q + 4 - 4q$
$8q = 4$
$q = 1 / 2$

Mixed Nash equilibria
(A, B) = (2 / 3, 1 / 3)
(D, E) = (1 / 2, 1 / 2)

2. Decision Making

(a)

1. Blackjack: (D) POMDP
2. Candy Crush: (B) MDP
3. Chess: (E) None/Other
4. Minesweeper: (D) POMDP
5. Snakes and Ladders: (A) MP
6. Texas Hold ’em Poker: (E) None/Other

(b)
$\pi(S1)$ = Stay
$\pi(S2)$ = Stay
$\pi(S3)$ = Stay or Leave

If the discount factor is very high, the value of state is hard to converge, so consider the value of state with state transition, I determine the S1 stay is positive, leave is negative or 0; S2 stay is 0, leave is negative; S3 both are negative.

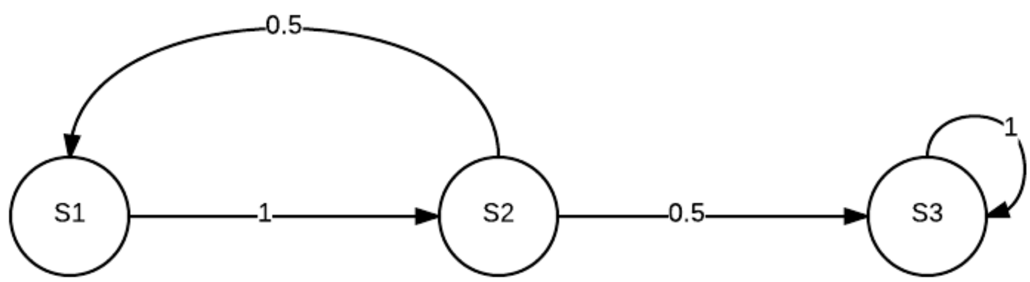
(c)
$\pi(S1)$ = Stay
$\pi(S2)$ = Leave
$\pi(S3)$ = Stay or Leave

Since the discount factor is very low, the future part could be ignored, thus just chose the action whose associated reward is higher.

(d)

	V0(s)	V0(s, S)	V0(s, L)	V1(s)	V1(s, S)	V1(s, L)	V2(s)	V2(s, S)	V2(s, L)	V3(s)
s1	0	1	0	1	1.6	3	3	2.8	2.82	2.82
s2	0	0	5	5	3	4.7	4.7	7.82	4.94	7.82
s3	0	-2	-2	-2	-3.2	-3.2	-3.2	-3.92	-3.92	-3.92

(e)



(f)

Since agent uses π this could see as Markov process problem

when $i = 0$
$v_0(s1) = v_0(s2) = v_0(s3) = 0$

when $i > 0$
$v_i(s1)$
$= u(s1, L) + \delta P(s1, L, s2)v_i(s2)$
$= \delta v_i(s2)$

$v_i(s2)$
$= u(s2, L) + \delta(P(s2, L, s1)*v_{i-1}(s1)+P(s2, L, s3)*v_{i-1}(s3))$
$= 5 + \delta(0.5*v_i(s1) + 0.5*v_i(s3))$

$v_i(s3)$
$= u(s3, S) + \delta P(s3, S, s3)v_i(s3)$
$= -2 + \delta v_i(s3)$

According to
(1) $v_i(s1) = \delta v_i(s2)$
(2) $v_i(s2) = 5 + \delta(0.5*v_i(s1) + 0.5*v_i(s3))$
(3) $v_i(s3) = -2 + \delta v_i(s3)$

Get:
(1) $v_i(s1) = \frac{\delta(10-12\delta)}{(1-\delta)*(2-\delta^2)}$
(2) $v_i(s2) = \frac{10-12\delta}{(1-\delta)*(2-\delta^2)}$
(3) $v_i(s3) = \frac{-2}{1-\delta}$

When δ is very high like $\delta = 0.999$

Vi of all 3 states will be negative. This could part support my intuition.
To fully support my intuition, need to consider more actions.

Consider about other possible policy like
$\pi_2(S1)$ = Stay, $\pi_2(S2)$ = Stay, $\pi_2(S3)$ = Stay or Leave (since two action result in same value)
Then

$v_i(s1) = \frac{1}{1-\delta}$	which is positive if δ is very high
$v_i(s2) = 0$	always 0
$v_i(s3) = \frac{-2}{1-\delta}$	which is negative is δ is very high

π_3(S1) =Stay, π_3(S2) = Leave, π_2(S3) = Stay or Leave

$v_i(s1) = \frac{1}{1-\delta}$ which is positive if δ is very high

$v_i(s2) = \frac{10-11\delta}{2-2\delta}$ which is negative is δ is very high

$v_i(s3) = \frac{-2}{1-\delta}$ which is negative is δ is very high

π_4(S1) = Leave, π_4(S2) = Stay, π_4(S3) = Stay or Leave

$v_i(s1) = 0$ always 0

$v_i(s2) = 0$ always 0

$v_i(s3) = \frac{-2}{1-\delta}$ which is negative is δ is very high

Thus π_2(S1) = Stay, π_2(S2) = Stay, π_2(S3) = Stay or Leave is the best.
After considering more actions, my intuition in 2b is supported.

When δ is very low like $\delta = 0.001$

Vi of all 3 states will be close to their reward of action in π

$v_i(s1)$ close to 0

$v_i(s2)$ close to 5

$v_i(s3)$ close to -2

It supports my intuition of question 2c since vi is close to action associated reward, so the higher associated reward action will be the optimal policy.