355 fall 2022 assignment 8

For this assignment, post CLARIFYING QUESTIONS ONLY on eclass. Posting suggestions or your answers or hints on eclass or any other site – e.g. a discord server or anywhere else – is plagiarism.

You can work on this assignment in groups of up to 5: within your group, you can discuss any questions, but you cannot copy answers. Each student must submit their own assignment. Discussing or copying with any student outside your group is plagiarism.

We might ask you later to explain your answers: if you are unable to do so, we might deduct some or all marks and report this to the faculty of science.

For this assigment, each student's secret number is the 4th and 5th integer of their student id, interpreted as a 2-digit number. E.g. if your id is `***91**`, then your secret number is 91. Some questions ask you for m, your secret number mod 3. E.g. if your secret number is 91, your m is 1.

Submit each answer on eclass.

1. **If you do not answer this question we will not mark the assignment and your assignment score will be 0.**

   (a) In your own words, state that you accept the plagiarism policy above.

   (b) Give the names and ccids of all members of your discussion group (including yourself). Explain how you worked together: e.g. discussed every question, discussed only questions 1 and 3 with group members X and Z, etc.

Recall: m is your secret number. Use your P_m for the next questions. P_m is the payoff matrix for row player Rose in a 2-person 0-sum simultaneous move game, e.g. like rock-paper-scissors. Colin is the column player: since the game is 0-sum, his payoff matrix is the negative of P_m.

```
P_0      R   P   S       P_1      R   P   S       P_2      R   P   S
    R    1  -1   2           R    2  -2   1           R    1  -1   2
    P    0   1  -1           P    1   0  -2           P   -1   1  -2
    S   -3   2   0           S   -2   1  -1           S    0   2  -1
```

2. Rose and Colin play deterministically: each picks one pure strategy.

   a) For Rose, give her minimax value and a minimax strategy. Explain briefly.

   b) Repeat a) for Colin.

In questions 3,4,5, Rose and Colin play stochastically.

3. a) Assume that Colin picks mixed strategy (R 1/3, P 1/2, S 1/6). For each pure strategy R, P, S for Rose, give Rose's expected payoff.

   b) Repeat a), exchanging Rose and Colin.

4. a) Formulate the problem of finding a minimax strategy for Rose as a linear program (LP) with objective function z. Don't find this strategy: just give the LP.

   b) Repeat a) for Colin.

5. Use your LP Q_m below (m is your secret number). Q_m comes from a 3-row 2-column matrix game: Rose uses Q_m to find her minimax value and a minimax strategy. Format your answers as in this course handout:

   http://webdocs.cs.ualberta.ca/~hayward/355/vnequi.pdf

```
Q_0:  max z so that
  z <= 2a +  b -  c
  z <= -a + 2b + 2c
  0 <= a,b,c <= 1
  a + b + c = 1
```

```
Q_1:  max z so that
  z <=   a +  b -  c
  z <= -3a + 2b + 2c
  0 <= a,b,c <= 1
  a + b + c = 1
```

```
Q_2:  max z so that
  z <=  3a +  b -  c
  z <= -2a + 2b + 2c
  0 <= a,b,c <= 1
  a + b + c = 1
```

   a) Give the original matrix game.

   b) Give the sagemath program that solves Q_m and the sagemath output.

   c) Give the LP Colin uses to find his minimax value and a minimax strategy. You do not have to solve this linear program. Format your answer as above: the first line should be `max z so that` .