THE UNIVERSITY OF MELBOURNE

Student number

Semester 2 Assignment 1, 2021

School of Mathematics and Statistics

MAST30022 Decision Making

Submission deadline: **4pm (Melbourne time), Friday 27 August**

This assignment consists of 9 pages (including this page)

Instructions to Students

- If you have a printer, print the assignment one-sided.

Writing

- Write your answers in the boxes provided on the assignment that you have printed. If you need more space, you can use blank paper. Note this in the answer box, so the marker knows. The extra pages can be added to the end of the assignment to scan.
- If you have been unable to print the assignment write your answers on A4 paper. The first page should contain only your student number, the subject code and the subject name. Write on one side of each sheet only. Start each question on a new page and include the question number at the top of each page.

Scanning

- Put the pages in number order and the correct way up. Add any extra pages to the end. Use a scanning app to scan all pages to PDF. Scan directly from above. Crop pages to A4. Make sure that you upload the correct PDF file and that your PDF file is readable.

Submitting

- Go to the Gradescope window. Choose the Canvas assignment for this assignment. Submit your file. Get Gradescope confirmation on email.

Question 1

Consider the two-player extensive-form game shown in Figure 1.

Player 0 is Chance, or Nature.

Each leaf is labelled with an *outcome* O, which is the result of the game should that leaf be reached.

The two information sets of Player II are denoted by U_{II}^1 and U_{II}^2.

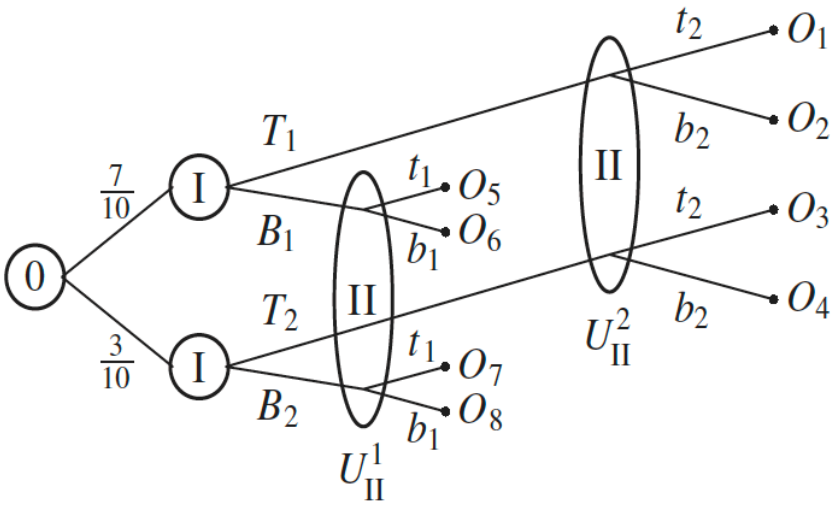

Figure 1: Game in extensive form.

(a) Write out all the strategies of each player.

(b) How many different plays of the game are possible?

Justify your answer.

(c) What does Player II know, and what does she not know, at each of her information sets?

(d) Depict the same game as a game in extensive form in which Player I makes his move prior to the chance move, and Player II makes her move after the chance move.

Question 2

Consider the three-player extensive-form game shown in Figure 2.

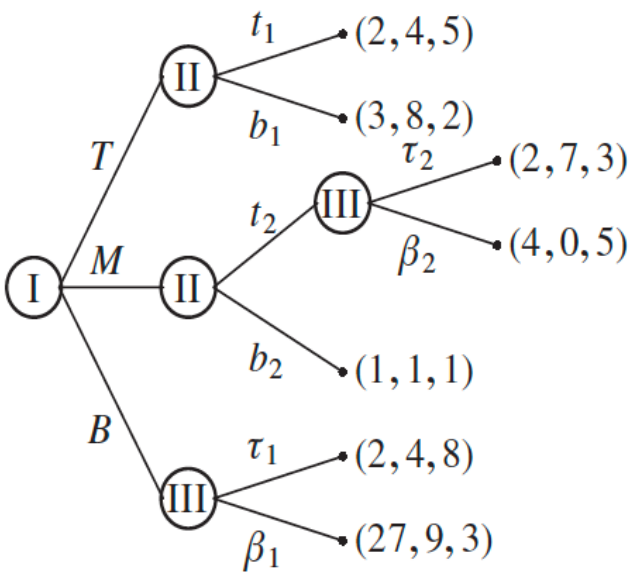

Figure 2: Game in extensive form.

(a) Describe the game in normal form.

If required, continue your solution in the box below.

(b) Find all the equilibria in pure strategies, if any exist.

Question 3

Prove Theorem 7 on Slide 52.

That is, for any two-person zero-sum game $\boldsymbol{V}$, $(\boldsymbol{x}^*, \boldsymbol{y}^*) \in X \times Y$ is in equilibrium if and only if $s(\boldsymbol{x}^*) = v_1 = v_2 = S(\boldsymbol{y}^*)$.

If required, continue your solution in the box below.

Question 4

Consider the following two-person constant-sum game

$$\begin{bmatrix} (4,8) & (5,7) & (7,5) \\ (3,9) & (2,10) & (5,7) \\ (8,4) & (9,3) & (2,10) \\ (5,7) & (6,6) & (6,6) \end{bmatrix}.$$

Use the linear programming method, possibly in combination with other methods (eg. saddle points, dominance elimination, 2×2 formulae, etc.) when necessary, to determine the values and optimal strategies for both players of this two-person constant-sum game.

If required, continue your solution in the box below.

End of Assignment