Mahindra University - Hyderabad
École Centrale School of Engineering
End-Term SET-2

Program: B. Tech. Branch: All
Year: 3rd year Semester: 2nd
Subject: Mathematical Methods for Principles of Economics (HS-3219)

Date: 03-06-2024 **Start Time: 10 am**
Time Duration: 180 minutes **Max. Marks: 100**

Instructions:

1) **All questions are compulsory**
2) Please check out for sub-questions under some questions
3) Regular calculator is allowed inside the exam hall

Section 1 (Each question carries 5 marks)

1. Study the table given below:

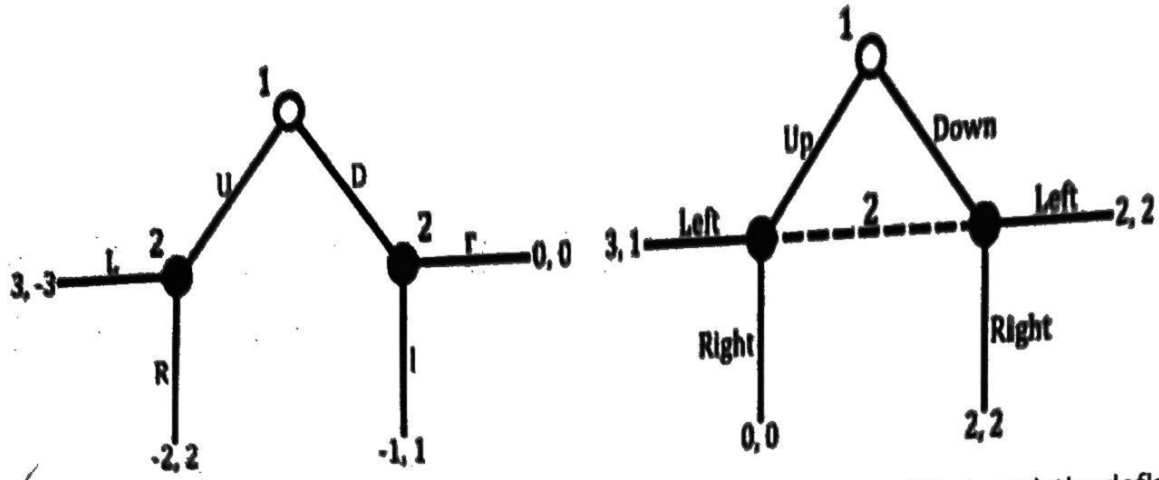
	Try	Fail
Try	0,0	-1,1
Fail	1,-1	0,0

a. Is there a dominant strategy for player 1? Substantiate your answer (2)
b. Is there a dominant strategy for player 2? Substantiate your answer (2)
c. What is the Nash equilibrium of the game? (1)

2. Two generals each have three units and are preparing for an upcoming battle. Each can choose to send any number of units to the fight or none at all. The side with more troops wins the battle, and the fight will draw if there are equal forces. Victory is worth 1 point; defeat is worth -1 points. If the sides draw or at least one side refuses to fight, both sides earn 0.
   a. Formulate the game (2.5)
   b. Point out the Nash equilibrium (s) in the game? (2.5)

Section 2 (Each question carries 15 marks)

3. Study the following games.
   a. Find the subgame perfect equilibrium of the games given below using the method of backward induction.
   b. Elucidate on how you reached the subgame perfect equilibrium in both the games in detail.
   c. Do you think player 1 have a first mover advantage in these games?



4. There is deflation in the economy. Do you think the following measures will help curb the deflation rate? How and why?
   a. Increasing the tax rate
   b. Decreasing the repo rate
   c. Buying treasury bills/govt securities via open market operations
   d. Decreasing the government expenditure
   e. Which of the above (a to d) can be categorized as monetary and fiscal? Briefly pinpoint why.

5. Suppose $200 of currency is in circulation.
   a. Calculate the money supply if there is no banking system
   b. Draw the assets and liability column with 100% reserve banking system (banks hold 100% of deposits as reserves, make no loans)
   c. Draw the assets and liability column in a fractional reserve banking system (where cash reserve ratio is 20%)
   d. What is the maximum amount that the money supply could increase in each of the following cases (a to c)?
   e. How should RBI change the Cash Reserve Ratio (CRR) in tune with the inflationary and deflationary tendencies?

6. Study the table below:

	Left	Right
Up	0, 1	-4, 2
Middle	0, 3	3, 3
Down	-2, 2	3, -1

   a. Is there strict dominant strategy equilibrium in this game for any of the players (2)
   b. Point out the weak dominant strategy equilibrium for both the players in the game if any. Elucidate your answer (5)
   c. Find out the Nash equilibrium (s) in the game (2)

d. Iterated elimination of weakly dominant strategies gives us no guidance about Nash equilibrium. Examine this statement using the above game (cue: use the iterated elimination strategy in the game given above in three different ways. Show the steps which leads to each answer) (6)

7. Two hunters enter a range filled with hares and a single stag. Hares are unintelligent and easy to capture. The stag, on the other hand, is cunning—the hunters can only catch it by working together. Without any communication, the hunters independently choose whether to hunt hares or the stag. If they both hunt hares, they each capture half of the hares in the range. If one hunts the stag and the other hunts hares, the stag hunter goes home empty-handed while the hare hunter captures all of the hares. Finally, if both hunt the stag, then each of their shares of the stag is greater than the value of all of the hares.

a) Formulate the game (3)
b) Point out the Nash equilibrium (s) (pure and mixed) of the game (if any) (3)
c) Re-formulate the game as in a sequential move game (cue: playing 1 is playing first) (3)
d) The subgame perfect equilibrium obtained when the player 1 has a first mover advantage is advantageous for both the players than the pure and the mixed strategy Nash equilibrium. Elucidate on this statement. (4)
e) Explain the relationship between Nash equilibrium and subgame perfect equilibrium? (2)

8. A man and a woman want to go on a date on a Friday evening in the 1980s. There are only two venues of entertainment in the city that night: a ballet and a fight. The woman wants to see the ballet. The man wants to see the fight. The payoff of seeing the fight is greater for the man than for the woman and vice versa. However, they both prefer being together than being alone, as they will have to go home immediately if the other does not show up at the location they choose (with their pay-offs being nil). A simple cell phone call, text message, or email would simplify the coordination process, but the 1980s lacked those luxuries. As such, both must choose where to go simultaneously and without the ability to communicate with one another.

a. Formulate the game based on the information given above (3)
b. Is there any dominant strategy equilibrium for any players for the above game? If not, why? (2)
c. Point out the pure strategy Nash equilibrium(s) if any (2)
d. Find out the mixed strategy Nash equilibrium. Is the mixed strategy equilibrium valid here? (4)
e. Find out the expected utility of the two players (2)
f. Is this a zero-sum game? Briefly pinpoint why (2).