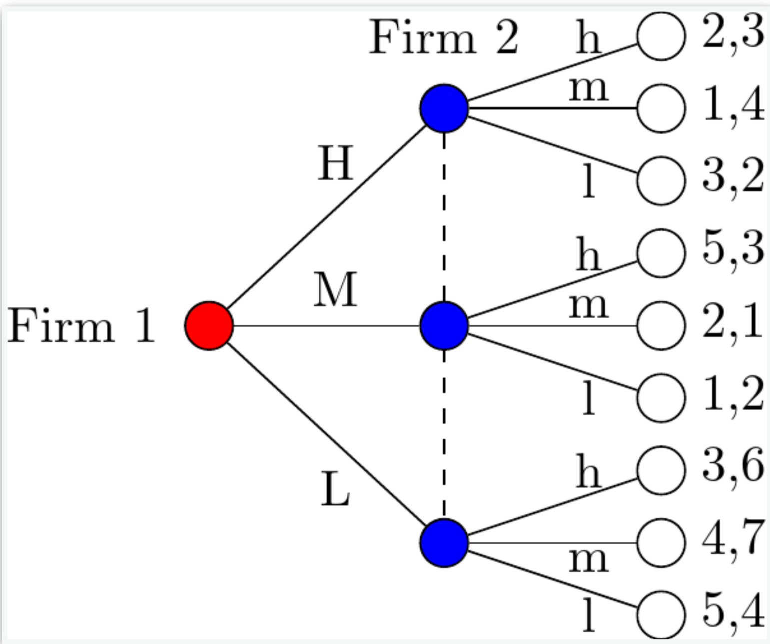
1. Consider the following game in the normal form. **(CO 1)**

		Firm 2		
		h	m	l
Firm 1	H	2,3	1,4	3,2
	M	5,3	2,1	1,2
	L	3,6	4,7	5,4

i. Write it as an extensive form game (game tree). **(1)**
Answer.

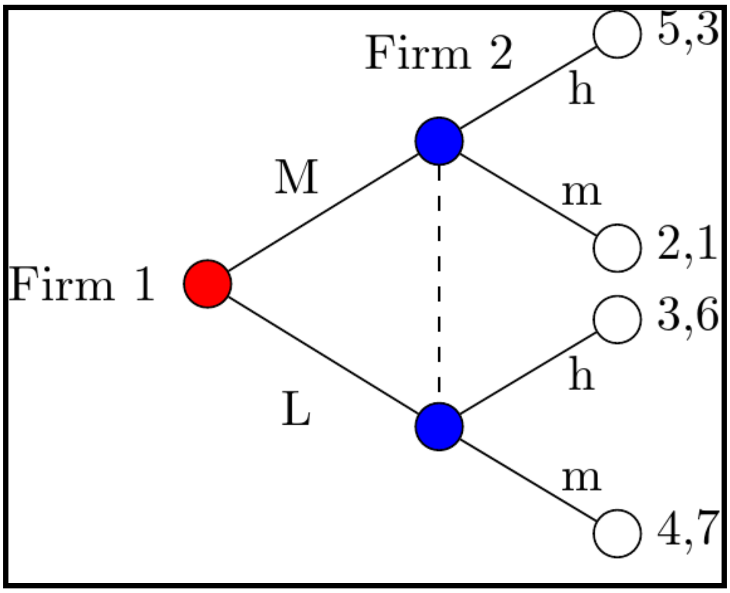


ii. Use IESDS to see what remains of the game **(1)**
Answer.

		Firm 2		
		h	m	l
Firm 1	H	2,3	1,4	3,2
	M	5,3	2,1	1,2
	L	3,6	4,7	5,4

**Order of elimination: a. L dominates H and b. H dominates l after that.

iii. Write what is left of the game in extensive form **(0.5)**
Answer.



2. In the single person decision problem, explain how actions map to outcomes. Your action set is $a \in [0,1]$ and possible outcomes are $O \in \{1, -1\}$. Suppose the outcome is never certain for any given action. **(CO 1)**

i. Show me what the expected payoff would look like for a given action. **(1)**
Answer. You have to consider a possible expected payoff for every a. Let us call the probability of $O = 1$ for a given value of a to be $p(1 \mid a)$. Therefore, the probability of $O = -1$ becomes $p(-1 \mid a) = 1 - p(1 \mid a)$. Payoffs are a function of outcomes. Let us define the payoff function as $\pi(O)$. Therefore, the expected payoff for a given action a is
$E[\pi(O \mid a)] = p(1 \mid a)\pi(1) + (1 - p(1 \mid a))\pi(-1)$

ii. How many such expected payoff functions exist in our setting **(1)**
Answer Since there are infinite possibilities for a, infinite such functions exist.

3. Both in single person problems with uncertainty, and in game theoretic settings, an action does not guarantee specific outcomes. However, there is a fundamental difference in why that happens. Explain (you may use an example, but you must not miss the point). **(1) (CO 1)**
Answer. The fundamental difference is that in a strategic/game theoretic environment, there is a rival actively optimising as well, whereas in stochastic environments the eventual payoff is affected by the outcome of a random draw. This also affects the way the agent makes choices, as in once case the agent is able to anticipate potential actions of a rival, while in the other case one is only able to rely on whatever information is available in the underlying probability distribution of the the random variable.

Of course, one may face a situation which is both game theoretic and has some random variables.

4. Suppose you have 4 actions available to you, $A_i = \{w, x, y, z\}$, while your rival's actions

set is simply $A_j = [0,2)$, and his action is given by a_j where $a_j \in A_j$. Now upon selecting a specific action, your payoff is a function of your rival's action. Suppose **(CO 1)**

(a) When you select w, your payoff is $v_i(w, a_j) = a_j^2 - 1$

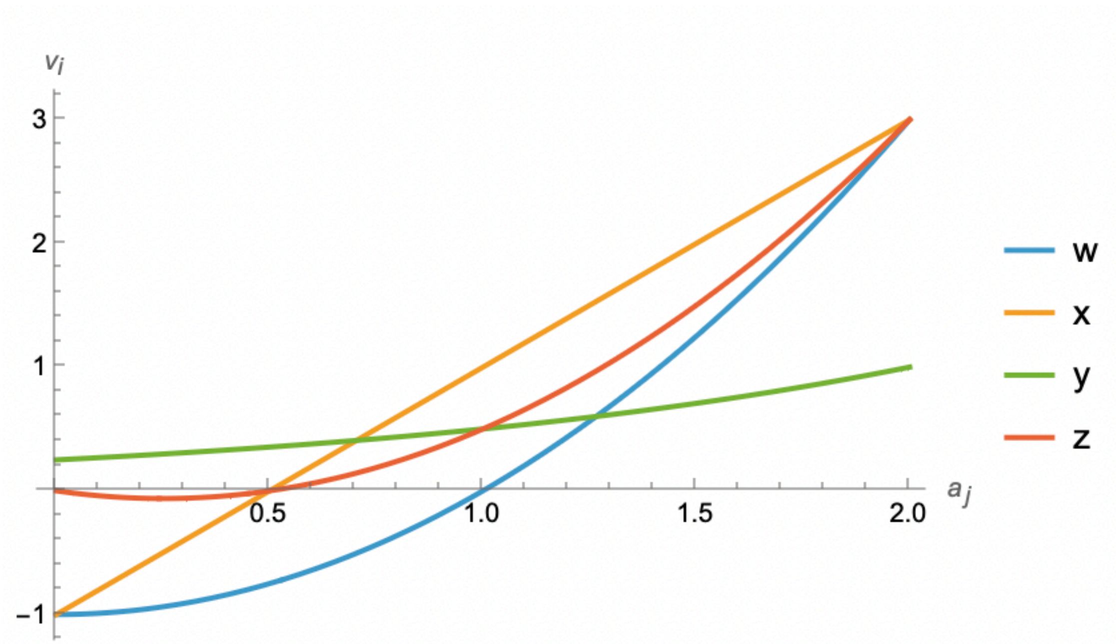
(b) When you select x, your payoff is $v_i(x, a_j) = 2a_j - 1$

(c) When you select y, your payoff is $v_i(y, a_j) = \left(\frac{1}{2}\right)^{2-a_j}$

(d) When you select z, your payoff is $v_i(z, a_j) = a_j^2 - 0.5a_j$

In the above question, compare the possible bilateral eliminations from IESDS and IEWDS. Are the the possibilities identical? **(1)**

Answer.



Since 2 is not included in the action set, z strongly dominates w. However, x only weakly dominates w as 0 in included in the action set. Other than that, no domination exists.

5. Consider a generic coordination game (next page) **(CO 2)**

	H	G
H	A, a	C, b
G	B, c	D, d

Read up online of from books and explain to me the concept of risk dominance (i.e., explain when one Nash equilibrium risk dominates another) **(1)**

Answer. To put it simply, strategy pair (G, G) risk dominates (H, H) if $(C - D)(c - d) \geq (B - A)(b - a)$. A more refined definition can also be given, in terms off You probably saw this online or in a text book. There is another way to write it in terms of expectations as well, and if you did so, that is fine, but it requires an explanation.

Let us understand this concept better. The idea here is that deviation from the risk dominant equilibrium is “more risky”. Even though there are two Nash equilibria in the game, the more a player feels uncertain about the rivals’ choice, the more likely he is to choose the action in the risk dominant NE. This is different from the Pareto criteria as it concerns itself more with the loss one faces from choosing an action linked to an equilibrium rather than the gains in absolute terms from being in one. This concept helps explain towards which NE people tend to move in game, given that they do not know what their rival will choose, especially in the absence of credible commitments.