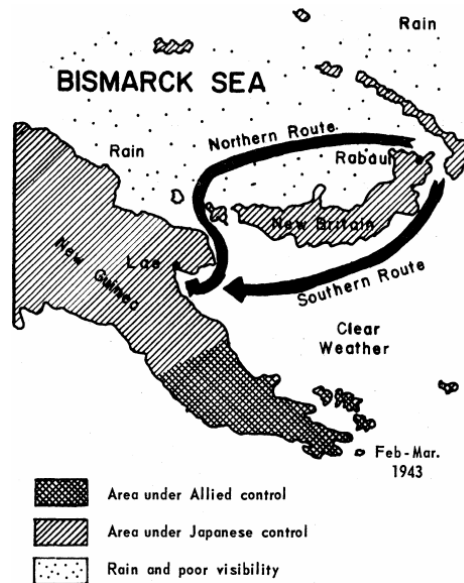


GSOE9210 Engineering Decisions

Problem Set 09

1. Consider the 'Battle of the Bismarck Sea' discussed in lectures.



- (a) Can this be represented as a zero-sum game?
 - (b) Represent the game in extensive form (*i.e.*, as a game tree).
 - (c) Represent the game in normal (strategic) form (*i.e.*, as a game matrix).
 - (d) Simplify the problem by eliminating dominated strategies.
 - (e) Which, if any, are the rational 'solutions' to the game?
2. Consider the 'Jailbreak game' from lectures. Suppose that neither the prisoner (P) nor the guard (G) know the other's move.
 - (a) Is the game zero-sum?
 - (b) Draw the game tree for this game.
 - (c) Convert this to extensive form, with the prisoner as the row player.
 - (d) Simplify the game using dominance.
 - (e) Repeat the above for the game in which the prisoner knows which wing the guard will patrol (*i.e.*, N or S).
 3. Use dominance to solve the following zero-sum game (payoffs are for the row player):

	b_1	b_2	b_3	b_4
a_1	0	1	7	7
a_2	4	1	2	10
a_3	3	1	0	25
a_4	0	0	7	10

4. Use dominance to reduce the following zero-sum games:

	b_1	b_2	b_3
a_1	3	8	3
a_2	0	1	10
a_3	3	6	5

	b_1	b_2	b_3	b_4
a_1	1	2	3	3
a_2	1	5	0	0
a_3	1	6	4	1

5. Consider the following zero-sum game, in which mixed strategies are allowed.

		B	
		b_1	b_2
A	a_1	4	0
	a_2	1	4
	a_3	2	1

- (a) Which, if any, strategies can be eliminated by using dominance?
 (b) Show that if player A had a possible strategy a^* , with payoffs 2 and 3 in response to player B's strategies b_1 and b_2 respectively, then a^* would not be dominated.
6. Use dominance to solve the following matrix representation of a two-player non strictly competitive game.

		Y		
		b_1	b_2	b_3
X	a_1	0, 0	1, 2	0, 2
	a_2	1, 3	1, 4	0, 0

7. Two companies, X and Y, produce a similar product which earns a profit of \$1 per unit sold. The two companies compete for a total annual market of 4000 units. However, if either company (or both) advertises, the total annual market will increase by 50%.

If neither or both companies advertise then they split the market evenly. If only one advertises, then the one that advertises gains two-thirds of the market.

Company X is deciding whether to close production (exit this market), or continue, and if so, whether to advertise or not.

Company Y is committed to this market (*i.e.*, it won't leave), but is monitoring whether or not company X stays in the market before deciding whether or not to advertise.

If X stays, both companies must decide whether or not to advertise this year before they know whether the other will.

- (a) Draw the extensive form of this game.
- (b) Draw the corresponding game matrix from the perspective of player X.
- (c) Reduce this game to identify possible solutions.
- (d) Repeat the above for the case where the annual cost of advertising for each company is \$1000.