

**Intro to AI (331)**  
**Homework 04**  
**Borrelli**  
**Due: Wednesday, June 30th, 2021 by 11:59pm**

- Be sure to put your NAME and Section number on the first page.
- You must submit your solution to MyCourses in **PDF** format **only**.
- Late work is not accepted.
- Only the last thing submitted to the dropbox will be accepted.

1. **(12 Points)** It's February 1943, the Island of New Guinea during World War II. The Allies control the southern coast of the island, and the Japanese control the northern coast. The Japanese are bringing in reinforcements – lots of them – from China and Japan. They've already reached the city of Rabaul. Rabaul is on the eastern tip of an island called New Britain. The troops massed in Rabaul are intended for the city of Lae in New Guinea. They'll be convoyed by ship, and everybody knows it. What's not clear is what route they'll take. New Britain runs east-west, so the trip will be either along the north coast of New Britain or the southern coast. Either way, it's a three-day trip. The significant difference is the expected weather. To the south, the weather is clear; to the north, the weather is stormy. The Japanese fleet is fine with either kind of weather.

It's the Allies who care about the weather. They're going to send recon planes to find the fleet, then bombers to bomb it. In clear weather, both of these things can be done on the same day. In bad weather, the bombers go out a day after the enemy fleet is sighted. That cuts down on bombing days, and of course, if you don't even find the fleet, you can't bomb it at all. The recon planes can't search both routes on the same day. All of this information is known to both sides. Which route (north or south) should the Japanese commanders sail, and which route (north or south) should the Allied Forces commanders search?

2. **(4 Points)** A dominant strategy is a Nash equilibrium. Is a Nash equilibrium necessarily a dominant strategy? (If your answer is “yes”, prove this. If your answer is “no” provide a counter-example.)
3. **(12 Points)** Two vendors are selling breakfast items. The price depends on demand. The Fixed cost for making breakfast sandwich is \$2; the fixed cost for a danish is \$1. Payoffs are represented as profits for Danish and Sandwich sellers respectively.

	Sandwich: \$3	Sandwich: \$4	Sandwich: \$5	Sandwich: \$6
Danish: \$3	$D = 40, S = 12$	$D = 44, S = 22$	$D = 48, S = 28$	$D = 39, S = 18$
Danish: \$4	$D = 36, S = 14$	$D = 42, S = 24$	$D = 46, S = 32$	$D = 38, S = 24$
Danish: \$5	$D = 16, S = 17$	$D = 24, S = 26$	$D = 32, S = 36$	$D = 40, S = 16$
Danish: \$6	$D = 32, S = 18$	$D = 48, S = 25$	$D = 50, S = 29$	$D = 41, S = 32$
Danish: \$7	$D = 42, S = 19$	$D = 36, S = 18$	$D = 49, S = 17$	$D = 42, S = 28$

- (a) Find the Nash Equilibrium using Iterated Elimination of Dominated Strategies (IEDS). Show your work with each iteration by specifying which row/column is dominated and eliminated.
- (b) Show any/all cells that strongly Pareto Dominate the Nash Equilibrium value.

4. **(14 Points)** The game “Rock-Paper-Scissors-Lizard-Spock” is an extension to the popular “Rock-Paper-Scissors.” In addition to the usual rules of Rock smashes Scissors, Scissors cuts Paper and Paper covers Rock, we also have:

- Rock crushes Lizard
- Lizard poisons Spock
- Spock smashes Scissors
- Scissors decapitates Lizard
- Lizard eats Paper
- Paper disproves Spock
- Spock vaporizes Rock

- (a) Fill in the payoff matrix for this game using values of 0 for a tie,  $-1$  for a loss and  $+1$  for a win.
- (b) If Player A is utilizing the following mixed strategy:
- Lizard = 22%
  - Spock = 25%
  - Rock = 20%
  - Paper = 15%
  - Scissors = 18%

What are the expected Payoff values for each option for Player B?

- (c) Based on the expected Payoff values for Player B, what is the best mixed strategy for Player B?