Written answers are acceptable so long as they are legible. Remember, you can work with others but you must write the answers on your own. IF YOU WORK WITH OTHERS YOU MUST NOTE WITH WHOM YOU WORKED IN YOUR ANSWER.

A note: If Jake, Julie, or Carlos violates Axiom 3 of Savage the preference relation "$\succ$ given a" really doesn't make sense. If it happens that any of them violates Axiom 3, consider those axioms where $\succ$ given a is replaced by simply $\succ$.

Problem 1

Suppose Julie who is very affraid of taking gambles. Julie uses minimax to compare two different gambles. She starts with a preference relation $\succ$ over the prizes in Z, and then compares two different actions using this preference relation. She looks at the worst prize (according to $\succ$) that has non-zero probability in each action, and compares them. If one action, f, gives a better worst prize than another, g, she chooses f. If they are tied she looks at the second worst prize (according to $\succ$) – she uses lexicographic minimax.

Part A

Which axioms of Anscombe/Aumann does she violate?

Part B

Which axioms of Savage does she violate?

Extra Credit

For extra credit say what axioms she would violate in each theory if she use non-lexicographic minimax.

Problem 2

In the last homework I gave you the lexicographic preference relation over macaroni salad and mashed potatoes. Suppose Carlos has a subjective utility function over the states of the world, and compares two actions according to that lexicographic preference relation (using his subjective utility function). Which axioms of Savage will Carlos violate?

Problem 3

I mentioned in class that Savage's Axiom 4 also rules out state dependent utility. How so? (Give an example of state dependent utility and show how it violates Axiom 4).

Problem 4

In the solutions to homework 3, I gave you the example of Jake. For Jake there were two prizes $Z = \{\$0, \$1\}$. Jake grouped all gambles into two categories, either they gave him a greater than 0.5 probability of getting \$1 or not. He regarded all gambles in each category as equivalent to one another, but preferred those gambles who had a chance higher than 0.5 of giving him \$1 to those that has a chance lower than (or equal to) 0.5 of giving him \$1. In the solutions I said Jake violates Axiom 2 of von Neumann/Morgenstern, but neither of the other two.

Assume Jake has a subjective utility function over the states, which he then uses to compare actions according to the rule above. Which axioms of Savage will Jake violate?

Graduate student problems (extra credit for undergrads)

Problem 5

Prove that Savage's theory requires that one respect dominance by proving the following statement. Since this is used in some proofs of the representation theorem for Savage, prove this without appealing to that theorem.

Proposition 1. *Let $A = \{A_1, A_2, \ldots, A_n\}$ be any partition of S. Prove that if $f \succ g$ given A_i for all $A_i \in A$, then $f \succ g$.*

Problem 6

Prove that if Z is finite, Savage's Axiom 6 is implied by the other axioms.