

# Quiz 2

## ECEn 370

Name: \_\_\_\_\_

1. Consider a roll of a three sided die (don't ask me how to build one), with faces numbered 1 through 3. Let  $\zeta$  be the outcome of the experiment (i.e.  $\zeta$  is the number rolled). Define two events:

$$E = \{ \zeta \mid \zeta = 3 \} = \{3\} \text{ and } F = \{ \zeta \mid \zeta = 1 \} = \{1\}.$$

a) Define the sample space,  $\Omega = \{1, 2, 3\}$

b) Describe the minimum size (i.e. with fewest elements) sigma field,  $\mathcal{F}$ , on  $\Omega$  which contains  $E$  and  $F$ .

$$\begin{aligned} \mathcal{F} &= \{ \phi, E, F, E^c, F^c, E \cup F, E^c F^c, \Omega \} \\ &= \{ \{ \}, \{3\}, \{1\}, \{1,2\}, \{2,3\}, \{1,3\}, \{2\}, \{1,2,3\} \} \end{aligned}$$

All other unions, interesections, and complements are already included.

c) Is  $\mathcal{F}$  the power set? Yes. This is an exhaustive set of all  $2^3$  possible events/elements.

2. Sam claims to have a loaded (unfair) three sided die with the following probabilities:

$$P[\zeta = 1] = 0.7, P[\zeta = 2] = 0.4, P[\zeta = 3] = -0.1.$$

Prove that Sam is wrong by identifying one or more axioms his die violates.

Since  $P[3] < 0$ , this violates axiom 1.

Since the outcomes are disjoint and exhaustive,

$$P[\zeta = 1 \cup \zeta = 2 \cup \zeta = 3] = P[\Omega] = P[\zeta = 1] + P[\zeta = 2] + P[\zeta = 3] = 1.0.$$

This satisfies axiom 2,  $P[\Omega] = 1$ .