AMAT 362—Work Sheet 01

Dr. Justin M. Curry

Due: January 31, 2022. Worth 20 points.

Name: _____

Questions marked with a $\star$ have subjective answers and will only be graded for completeness.

1. (2 points) What's the probability of a 4 of a kind, assuming you're dealt a 5 card hand, uniformly at random, from a standard 52 card deck?

2. (1 point) $\star$ How much money do you need to make to be in the top 1% of income earners in the United States? What about the top 1% of New Yorkers? Do you think there is such a thing as a "fair" distribution of incomes? What does that look like?

3. (1 point) $\star$ What's the probability of life on Mars? What does this question illustrate about the different meanings of the term "probability"?

4. (1 point) $\star$ How many people should you date before settling down on "the one," assuming that's something you want to do?

5. (6 points) Translate each of the following symbolic expressions into English statements:
   (a) (1 point) $x \in A$

   (b) (1 point) $A \subseteq B$

(c) (1 point) A^c

(d) (1 point) $R \times S$

(e) (1 point) $|A|$

(f) (1 point) How do you interpret $\varnothing$ and Ω in probability?

6. (2 points) State De Morgan's Laws. What does this have to do with the star battle problem? `https://krazydad.com/tablet/starbattle/`

7. (2 points) Consider the set Ω, the union operation $A \cup B$ of subsets of Ω and the intersection operation $A \cap B$ on Ω. What does it mean to say that $\cup$ and $\cap$ are associative and symmetric? How does the union operation "distribute over" the intersection operation?

8. (5 points) Suppose we have a deck of 20 cards, 10 are red and 10 are blue. Each of the blue cards has a unique number between 1 and 10. Each of the red cards has a unique number also between 1 and 10.

   (a) (1 point) Describe the sample space Ω as a Cartesian product.

   (b) (1 point) Consider the following events:
   - Let A be the event that a card drawn has an even number on it.
   - Let B be the event that a blue card is drawn.
   - Let C be the event that a card with a number (strictly) less than 5 is drawn.

   What are the sizes of A, B, and C?

(c) (2 points) Describe the events $A \cup B \cup C$ and $A^c \cap B^c \cap C^c$.

(d) (1 point) What are the number of outcomes in each of the events in part (c)?