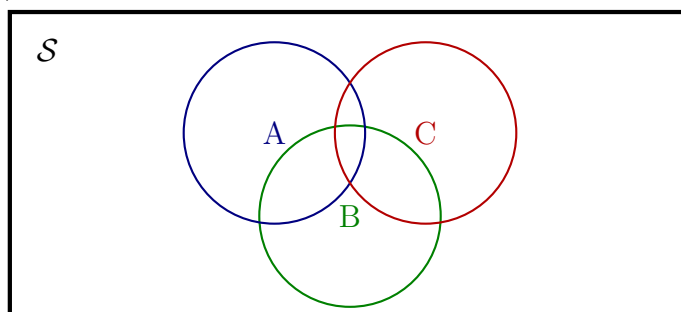## Instructions

(1) This assignment is due on Wednesday September Friday September 22nd.
(2) Please submit your written solutions to crowdmark with each problem started on a separate page.
(3) Please list your collaborators on your assignment. It's important to give credit to those you have worked with.

Question 1 (Set Theory)**.** Let A, B, C be sets in the following Venn diagram


Shade in each of the following sets:

a) $A^c \cup B \cup C$
b) $B \cap (A^c \cap C^c)$
c) $B \cup (A \cap C)$
d) $(A \cup C)^c \cap B$

Question 2 (Event Spaces)**.** Consider a game played by rolling two dice. The rules are as follows:
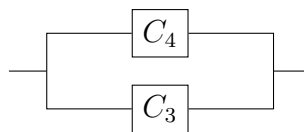
- You score one point for each six that comes up.
- If the numbers on both dice sum to seven, you score one point.
- If both numbers on the dice are one, then you lose all of your points.

Determine the event space for one roll of the dice. For each event, explain why the event is important for the game.

Question 3 (Basic Probability)**.** Electrical systems can be wired with components in either series, or in parallel:
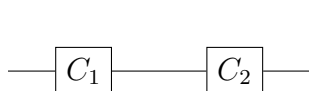

Components in series   Components in parallel

If two components are in series and one fails, the whole system fails. If two components are in parallel and one fails, the system will still function. If both components fail, then the whole system will fail.

Assume the probability of failure for each component is independent and equal to p. For each of the following systems, determine the probability that the whole system fails.

a)

C_1
C_2

b)

C_1 C_2

c)

C_1
C_2
C_3

d)

C_1 C_3
C_2 C_4
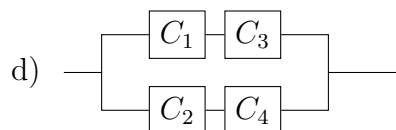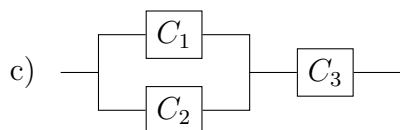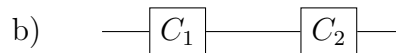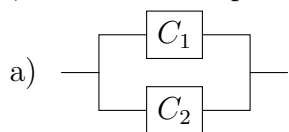
Question 4 (Counting Techniques). A "standard" deck of playing cards consists of 52 Cards in each of the 4 suits of Spades, Hearts, Diamonds, and Clubs. Each suit contains 13 cards: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, and King.

    a.) Suppose you and a friend each choose a card at random from the same deck. What is the probability that you have chosen cards with the same suit?

    b.) Suppose you and a friend each choose a card at random from the same deck. What is the probability that you have chosen cards with the same number?

    c.) Suppose you and a friend each choose a card at random from different decks. What is the probability that you have chosen the same card?

    d.) Suppose you and n friends each choose a card at random from n different decks of cards. What is the probability that at least two of you choose the same card?