1. In a poll conducted among 300 active investors, it was found that 120 use full-service (FS) brokers, 107 use discount (D) brokers and 110 use deep-discount (DD) brokers. From this survey, there are 52 who use both discount and full-service brokers, 36 use both discount and deep-discount brokers, while no one uses both full-service and deep-discount brokers.

   i) (5 pts.) Using the Venn Diagram below, put in the numbers of people in the survey corresponding to each of the 8 regions.

   ![Venn Diagram](image)

   ii) (2 pts.) Using the above Venn Diagram, how many use only deep-discount brokers?

   a) 36  b) 52  c) 74  d) 110

   iii) (3 pts.) Using the above Venn Diagram, how many use only one type of broker service?

   a) 68  b) 88  c) 161  d) 300

2. (5 pts.) Given the following Venn Diagram, which of the following corresponds to the shaded region.

   ![Venn Diagram](image)

   a) \(A \cup B\)  b) \(A^c \cap B \cap C\)  c) \(A \cap B \cap C^c\)  d) \((A \cup B)^c \cap C\)
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3. (5 pts.) Which of the following is \((A \cup B)^c\) equal to?

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

4. (5 pts.) How many ways can a civil jury of 6 members split 4 to 2 on a decision? Do not do all the arithmetic, leave your answer unsimplified.

5. An experiment consists of dealing a 2-card hand from a well-shuffled standard deck of 52 cards.

   i) (5 pts.) List 3 elements in the sample space

   ii) (5 pts.) How many elements in the sample space?
   Do not do all the arithmetic, leave your answer unsimplified.

   iii) (5 pts.) What is the probability of getting two cards of the same suit? Do not do all the arithmetic, leave your answer unsimplified.

   iv) (5 pts.) What is the probability of getting two cards that do not match in either suit or ranking/kind? Do not do all the arithmetic, leave your answer unsimplified.
6. (5 pts.) Which of the following does **not** correspond to the events $E$ and $F$ being independent events?

a) $p(E \cap F) = p(E) + p(F)$  
b) $p(E \cap F) = p(E) \times p(F)$  
c) $p(E|F) = p(E)$  
d) $p(F|E) = p(F)$

7. Consider the experiment of picking a card from a well shuffled standard deck of 52 cards and the event of picking a picture card where a Jack, Queen, King and Ace of any suit is considered a picture card.

i) (2 pts.) What is the probability of getting a picture card?

Now suppose we repeat this experiment 5 times, replacing the card and reshuffling each time.

ii) (4 pts.) Find the probability of getting a picture card exactly 3 times in the 5 trials. **Show all work needed to support your answer.**

iii) (4 pts.) Find the probability of getting a picture card one or more times in the 5 trials. **Show all work needed to support your answer.**

8. (5 pts.) An experiment has four possible outcomes: $a$, $b$, $c$, and $d$. If $p(a) = p(b)$, $p(c) = \frac{1}{3}p(a)$ and $p(d) = 2p(b)$, find $p(\{c,d\})$.

a) less that 0.3  
b) between 0.3 and 0.5  
c) between 0.5 and 0.7  
d) more than 0.7
For Questions 9 through 11, consider the following tree diagram describing probabilities concerning two events \( E \) and \( F \) and their complements.

\[ \begin{align*}
&0.2 & \quad 0.9 \\
\quad & E & \quad B \\
&0.8 & \quad 0.3 & \quad 0.1 \quad A \\
& & \quad 0.7 & \quad B \\
\end{align*} \]

9. (5 pts.) Find \( p(E \cap B) \).

a) 0.02  

b) 0.18  

c) 0.24  

d) 0.56

10. (5 pts.) Find \( p(A|F) \).

a) 0.1  

b) 0.9  

c) 0.3  

d) 0.7

11. (5 pts.) Find \( p(E|B) \).

a) \( \approx 0.0769 \)  

b) \( \approx 0.2432 \)  

c) \( \approx 0.7568 \)  

d) \( \approx 0.9231 \)

12. (5 pts.) Suppose that the events \( A \) and \( B \) are two events where \( p(A \cup B) = .45 \) and such that the following Venn Diagram is accurate.

\[ \begin{align*}
&0.2 & \quad 0.1 & \quad 0.15 \\
\quad & A & \quad B \\
\end{align*} \]

What is \( p(A|B) \) ?

a) 0.1  

b) 0.4  

c) \( \frac{1}{3} \)  

d) 0.25
13. (5 pts.) How many two symbol codes are there if one symbol must be a letter and the other must be a digit? eg: H3, 4K, 3H are all different codes.

a) $26^2 \times 10^2$  
b) $26 \times 10$  
c) $2 \times 26 \times 10$  
d) $(10 + 26)^2$

14. (5 pts.) If a pair of fair dice is thrown and the sum of the numbers shown is noted, how many ways can you obtain a sum of 9 or more?

Show all work needed to support your answer.

15. (5 pts.) A medical test has been designed to detect the presence of a certain disease. Among those who have the disease, the probability that the disease will be detected by the test is 0.95. However, the probability that the test will erroneously indicate the presence of the disease in those who actually do not have the disease is 0.04. It is estimated that 40% of the population who take this test have the disease. If the test administered to an individual is positive, what is the probability that the person actually has the disease?

Hint: Draw a tree diagram to help organize the information.
No partial credit; however, your answer must be supported with work shown.

a) less than 0.25  
b) between 0.25 and 0.5  
c) between 0.5 and 0.75  
d) more than 0.75
Bonus (extra credit) Questions:
Answer these questions only after you have finished all the previous questions.

**Question 16.** (5 pts.) The U.N. Security Council consists of 5 permanent members and 10 nonpermanent members. Decisions made by the council require nine votes for passage. However, any permanent member may veto a measure and thus block its passage. In how many ways can a measure be passed if all 15 members of the Council vote (no abstentions)? **Explain your reasoning and show all work needed to support your answer; leave your answer in unsimplified form.**

**Question 17.** (5 pts.) Suppose you are dealt 5 cards from a standard well-shuffled deck of 52 cards (with 4 suits: ♠, ♦, ♣, ♦ and 13 rankings: 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, Ace).

Find the probability of getting a pair with no better (i.e., two cards match in ranking, with the three other cards having 3 different rankings).

\[
a) \frac{C(4, 2) \times C(48, 3)}{C(52, 5)} \hspace{2cm} b) \frac{\frac{13 \times 12}{2!} \times 48 \times 44 \times 40}{C(52, 5)} \\
\hspace{2cm} c) \frac{52 \times 51 \times 50 \times 49 \times 48}{C(52, 5)} \hspace{2cm} d) \frac{13 \times C(4, 2) \times \frac{48 \times 44 \times 40}{6}}{C(52, 5)}
\]
Scrap: If you want any of the calculations written here to be counted as supporting work on a question, you must make reference to it here and in the space after the appropriate question.