1. (13 points) Sets $A, B, C$ are subsets of a universal set $U$, and they satisfy:

\[
\begin{align*}
n(A) &= 13 \\
n(B) &= 15 \\
n(C) &= 12 \\
n(A \cap B \cap C) &= 1 \\
n(A \cup B) &= 25 \\
n(A \cup C) &= 23 \\
n(B \cup C) &= 24 \\
n(U) &= 40
\end{align*}
\]

Find $n( A' \cap B' \cap C' )$. 

2. (12 points) Let \( \text{Pr} \) be a probability measure on \( S \) with \( E, F \subset S \). Assume that \( \text{Pr}[E \mid F] = \frac{1}{3} \), \( \text{Pr}[F \mid E] = \frac{1}{2} \), and \( \text{Pr}[E' \cap F'] = \frac{3}{5} \).

Find \( \text{Pr}[E] \), \( \text{Pr}[F] \), and \( \text{Pr}[E \cap F] \).
3. (13 points) Let $\Pr$ be a probability measure on $S$ with $E, F, G \subset S$. Assume that they satisfy:

\begin{align*}
\Pr[E] &= 0.55 & \Pr[F] &= 0.5 & \Pr[G'] &= 0.45 \\
\Pr[E \cap F] &= 0.3 & \Pr[E' \cap G'] &= 0.25 & \Pr[F \cap G'] &= 0.3 \\
\Pr[E \cap F \cap G'] &= 0.2
\end{align*}

Find $\Pr[E' \cap F' \cap G]$. 
4. (12 points) Two fair dice are rolled; so the sum of the two numbers is between 2 and 12. Let $E$ be the event that the sum of the numbers is 11 or 12. Let $F$ be the event that the sum of the numbers is 2, 3, or 11. Find $\Pr[E \mid F]$ and $\Pr[F \mid E]$. 
5. (12 points) Consider the following experiment: You start with a deck of 5 cards, \{\diamond 2, \diamond 3, \diamond 4, \diamond 5, \diamond 6\}. Now, shuffle the deck and deal them out on the table, one at a time; STOP when the sum of the numbers is 6 or greater. Find the sample space of this experiment. You can either draw a tree here, or you can just list all the possible outcomes. Note that you never deal the same card twice.
6. (13 points) An unfair die has probabilities \( w_1, w_2, w_3, w_4, w_5, w_6 \) of coming up 1, 2, 3, 4, 5, 6, respectively. Assume that 1 and 6 are equally likely, 2 and 5 are equally likely, and 3 and 4 are equally likely, but 2 is twice as likely as 1, and 3 is twice as likely as 2. Find \( w_1, w_2, w_3, w_4, w_5, w_6 \). Your answers should be a simple fraction (of form \( \frac{m}{n} \)).
7. (13 points) Let $S$ be the set of ten numbers, $\{1, 2, 3, \ldots, 10\}$. How many subsets of $S$ contain the same number of even numbers as odd numbers? Your answer should be a whole number. Examples of such sets are: 
\{2, 3\}, \{2, 4, 8, 1, 7, 9\}, \emptyset, S
8. (12 points) Start with a stack of 50 bills: 10 each of $1 bills, $5 bills, $10 bills, $20 bills, and $50 bills. You randomly choose 10 of them. What is the probability of choosing exactly 2 of each kind? Your answer should be of the form \( \frac{\text{product of whole numbers}}{\text{another product of whole numbers}} \); you don’t have to simplify it.
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