You may use your crib sheet, your calculator, and the tables provided. Please use no other outside source of information. Show your work.

(1) An urn contains 100 balls. There are 30 green, 50 red, and 20 blue balls.
(a) If 15 balls are selected one at a time and at random with replacement from the urn, what is the probability that on the 12th draw a blue ball is drawn?

(b) If 15 balls are selected one at a time and at random without replacement from the urn, what is the probability that on the 12th draw a blue ball is drawn?

(c) If 15 balls are selected one at a time and at random with replacement from the urn, what is the probability that a blue ball is drawn on the 12th draw and a red ball is drawn on the 8th draw?

(d) If 15 balls are selected one at a time and at random without replacement from the urn, what is the probability that a blue ball is drawn on the 12th draw and a red ball is drawn on the 8th draw?
(e) If 15 balls are selected one at a time and at random without replacement from the urn, what is the probability of obtaining exactly 5 red balls?

(f) If 15 balls are selected one at a time and at random with replacement from the urn, what is the probability of obtaining exactly 5 blue balls?

(g) If 15 balls are selected one at a time and at random without replacement from the urn, what is the probability of obtaining exactly 5 red balls, 8 blue balls, and 2 green balls?

(2) A and B are events for which $P(A) = 0.3$, $P(B) = 0.6$, and $P(A \cup B) = 0.8$.
(a) $P(A \cap B) =$

(b) $P(A | B) =$

(c) $P(A' \cup B) =$
(3) Toss a 5 sided die 10 times. Let $X$ denote the number of fours obtained in the 10 tosses.
(a) $P[X \leq 3] =$

(b) $P[X = 4] =$

(c) $E[X] =$

(4) (a) What is the probability of at least one double six in 24 throws of two 6 sided dice?

(b) What is the probability of at least one six in a single throw of four 6 sided dice?
(5) A person is selected at random from a population in which a proportion $p$ have been diagnosed as having Hylosis and is asked whether he has been diagnosed as having H. Since there is some social stigma associated with having H the following device, called the randomized response technique, is used to assure confidentiality. The person is told to roll an ordinary die and, without revealing to anyone the outcome of the die roll, if the outcome is either a 1 or a 2 then he is to lie, and if the outcome is 3,4,5,or 6 he is to respond truthfully.

(a) Letting the response be denoted by

$$X = \begin{cases} 
1 & \text{if he indicates he has H} \\
0 & \text{if he indicates he does not} 
\end{cases},$$

find the probability distribution function $f(x)$ of $X$.

(b) Compute $E[ 3X - 1 ]$.

(c) What is the variance of $X$?

(d) What is the conditional probability that he has been diagnosed as having H given that he reports that he has $(X = 1)$?
(6) In Martian poker a hand of 5 cards is dealt from an ordinary deck of 52. An important hand in Martian poker is the "RFP", any hand in which there are exactly three different face card values, King, Queen, and Jack, and two other cards of the same face value (not K, Q, or J). What is the probability of being dealt an RFP?

(7) Let $Y$ be the number of non-sixes rolled before the first six in repeatedly rolling a six sided die.
(a) $P[ Y > 5 ] =$

(b) $P[ Y > 5 \mid Y \leq 8 ] =$