Module I Question Bank

1. Three urns are there containing white and black balls; first urn has 3 white and 2 black balls, second urn has 2 white and 3 black balls and third urn has 4 white and 1 black balls. Without any biasing one urn is chosen from that one ball is chosen randomly which was white. What is probability that it came from the third urn?
2. A bag contains 4 balls. Two balls are drawn at random without replacement and are found to be blue. What is the probability that all balls in the bag are blue?
3. Illustrate Bayes rule and its use in artificial intelligence.
4. Show from first principles that $P(a \mid b \wedge a)=1$
5. Write a Decision Theoretical Agent algorithm and explain
6. For each of the following statements, either prove it is true or give a counterexample.
   a. If $P(a \mid b, c) = P(b \mid a, c)$, then $P(a \mid c) = P(b \mid c)$
   b. If $P(a \mid b, c) = P(a)$, then $P(b \mid c) = P(b)$
   c. If $P(a \mid b) = P(a)$, then $P(a \mid b, c) = P(a \mid c$
7. Three persons A, B and C have applied for a job in a private company. The chance of their selections is in the ratio 1: 2: 4. The probabilities that A, B and C can introduce changes to improve the profits of the company are 0.8, 0.5 and 0.3, respectively. If the change does not take place, find the probability that it is due to the appointment of C.
8. Show that the statement of conditional independence
   $P(X, Y \mid Z) = P(X \mid Z)P(Y \mid Z)$ is equivalent to each of the statements
   $P(X \mid Y,Z) = P(X \mid Z)$ and $P(B \mid X, Z) = P(Y \mid Z)$.
9. Consider the set of all possible five-card poker hands dealt fairly from a standard deck of fifty-two cards.
   1. How many atomic events are there in the joint probability distribution (i.e., how many five-card hands are there)?
   2. What is the probability of each atomic event?
   3. What is the probability of being dealt a royal straight flush? Four of a kind
10. Given the full joint distribution shown in Figure 13.3,
    calculate the following:

	toothache		*¬toothache*	
	catch	*¬catch*	*catch*	*¬catch*
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

Figure 13.3 A full joint distribution for the *Toothache*, *Cavity*, *Catch* world.

A. P(toothache).
B. P(Cavity).
C. P(Toothache | cavity).
D. d. P(Cavity | toothache ∨ catch)