

- 1) A card is drawn randomly from a deck of 52 ordinary playing cards. Let S be the event that the card is a spade; and let A be the event that the card is an ace. You win \$10 if the card is a spade or an ace. What is the probability that you will win the game? (7 marks)
- 2) In Quebec, 1000 vehicle accidents occur in a month, out of which 100 accidents are due to weather, 850 accidents are due to driver's misconducts, and 50 accidents are due to road quality. Human deaths often result from the accidents. It has been found that a death is caused due to weather with probability of 1%, driver's misconducts with probability of 2%, and road quality with a probability of 0.1%.
 - (a) What is the probability of accidents due to weather, drivers' misconducts and road quality? (3 marks)
 - (b) What is the probability of a death? (3 marks)
 - (c) If a death occurs, what is the probability that it is NOT due to driver's misconducts? (3 marks)
- 3) The probability mass function of the final temperature (in Kelvin) for 200 endothermic reactions involving sodium bicarbonate is summarized below

$$f(x) = \begin{cases} 0.24, & x = 266K \\ 0.30, & x = 271K \\ 0.46, & x = 274K \end{cases}$$

$P(X \leq 271)$
 $x = 266$ 271 274
 $F(x)$ 0.24 0.54 1
 $P(X \leq 271)$

- (a) Determine and plot the cumulative distribution function for the random variable X which denotes the final temperature (in Kelvin). Show all steps using the correct notation. (4 marks)
- (b) Using the cumulative distribution function, determine
 - (i) $P(X \leq 273K)$ (2 marks)
 - (ii) $P(X \leq 275K)$ (2 marks)
- 4) A metal fabricating plant currently has 5 major pieces under contract, each with a deadline for completion. Let X denotes the number of pieces completed by their deadlines. Suppose that X is a random variable with the probability mass function $f(x)$ given by

x	0	1	2	3	4	5
$f(x)$	0.05	0.1	0.15	0.25	0.35	0.1

- (a) Compute the expected value and variance of X . (4 marks)
- (b) The plant receives a fixed revenue of \$70,000 plus for each piece completed by the deadline, it receives a bonus of \$15,000. Find the expected value and variance of the total revenue amount. (4 marks)
- 5) A large chain retailer purchases a certain kind of electronic device from a manufacturer. The manufacturer indicates that the defective rate of the device is 3%.
 - (a) The inspector of the retailer randomly picks 20 items from a shipment. What is the probability that there will be at least one defective item among these 20? (4 marks)
 - (b) Suppose that the retailer receives 10 shipments in a month and the inspector randomly tests 20 devices per shipment. What is the probability that there will be 3 shipments containing at least one defective device? (4 marks)

10 : 1

20 : 1

1 Poisson
 $n = 20$

$70000 + 15000x$