Statistics-S1 - 2006-January

Question 1

Over a period of time, the number of people x leaving a hotel each morning was recorded. These data are summarised in the stem and leaf diagram below.

Number leaving	3	2 means 32	Totals
2	7 9 9		(3)
3	2 2 3 5 6		(5)
4	0 1 4 8 9		(5)
5	2 3 3 6 6 6 8		(7)
6	0 1 4 5		(4)
7	2 3		(2)
8	1		(1)

For these data,

(a) write down the mode,

(1)

(b) find the values of the three quartiles.

(3)

Given that $\Sigma x = 1335$ and $\Sigma x^2 = 71\,801$, find

(c) the mean and the standard deviation of these data.

(4)

One measure of skewness is found using

$$\frac{\text{mean} - \text{mode}}{\text{standard deviation}}.$$

(d) Evaluate this measure to show that these data are negatively skewed.

(2)

(e) Give two other reasons why these data are negatively skewed.

(4)

Question 2

The random variable X has probability distribution

x	1	2	3	4	5
$P(X=x)$	0.10	p	0.20	q	0.30

(a) Given that $E(X) = 3.5$, write down two equations involving p and q.

(3)

Find

(b) the value of p and the value of q,

(3)

(c) Var(X),

(4)

(d) Var$(3 - 2X)$.

(2)

Question 3

A manufacturer stores drums of chemicals. During storage, evaporation takes place. A random sample of 10 drums was taken and the time in storage, x weeks, and the evaporation loss, y ml, are shown in the table below.

x	3	5	6	8	10	12	13	15	16	18
y	36	50	53	61	69	79	82	90	88	96

(a) On graph paper, draw a scatter diagram to represent these data.

(3)

(b) Give a reason to support fitting a regression model of the form $y = a + bx$ to these data.

(1)

(c) Find, to 2 decimal places, the value of a and the value of b.

(You may use $\Sigma x^2 = 1352$, $\Sigma y^2 = 53\,112$ and $\Sigma xy = 8354$.)

(7)

(d) Give an interpretation of the value of b.

(1)

(e) Using your model, predict the amount of evaporation that would take place after

   (i) 19 weeks,

   (ii) 35 weeks.

(2)

(f) Comment, with a reason, on the reliability of each of your predictions.

(4)

Question 4

A bag contains 9 blue balls and 3 red balls. A ball is selected at random from the bag and its colour is recorded. The ball is not replaced. A second ball is selected at random and its colour is recorded.

(a) Draw a tree diagram to represent the information.

(3)

Find the probability that

(a) the second ball selected is red,

(2)

(b) both balls selected are red, given that the second ball selected is red.

(2)

Question 5

(a) Write down two reasons for using statistical models.

(2)

(b) Give an example of a random variable that could be modelled by

    (i)   a normal distribution,

    (ii) a discrete uniform distribution.

(2)

Question 6

For the events A and B,

$$P(A \cap B') = 0.32, \ P(A' \cap B) = 0.11 \text{ and } P(A \cup B) = 0.65.$$

(a) Draw a Venn diagram to illustrate the complete sample space for the events A and B.

(3)

(b) Write down the value of $P(A)$ and the value of $P(B)$.

(3)

(c) Find $P(A \mid B')$.

(2)

(d) Determine whether or not A and B are independent.

(3)

Question 7

The heights of a group of athletes are modelled by a normal distribution with mean 180 cm and a standard deviation 5.2 cm. The weights of this group of athletes are modelled by a normal distribution with mean 85 kg and standard deviation 7.1 kg.

Find the probability that a randomly chosen athlete

(a) is taller than 188 cm,

(3)

(b) weighs less than 97 kg.

(2)

(c) Assuming that for these athletes height and weight are independent, find the probability that a randomly chosen athlete is taller than 188 cm and weighs more than 97 kg.

(3)

(d) Comment on the assumption that height and weight are independent.

(1)