

- 1 In her purse, Katharine has two £5 notes, two £10 notes and one £20 note. She decides to select two of these notes at random to donate to a charity. The total value of these two notes is denoted by the random variable £ X .

(i) (A) Show that $P(X = 10) = 0.1$. [1]

(B) Show that $P(X = 30) = 0.2$. [2]

The table shows the probability distribution of X .

r	10	15	20	25	30
$P(X = r)$	0.1	0.4	0.1	0.2	0.2

(ii) Find $E(X)$ and $\text{Var}(X)$. [5]

- 2 Dwayne is a car salesman. The numbers of cars, x , sold by Dwayne each month during the year 2008 are summarised by

$$n = 12, \quad \Sigma x = 126, \quad \Sigma x^2 = 1582.$$

(i) Calculate the mean and standard deviation of the monthly numbers of cars sold. [3]

(ii) Dwayne earns £500 each month plus £100 commission for each car sold. Show that the mean of Dwayne's monthly earnings is £1550. Find the standard deviation of Dwayne's monthly earnings. [3]

(iii) Marlene is a car saleswoman and is paid in the same way as Dwayne. During 2008 her monthly earnings have mean £1625 and standard deviation £280. Briefly compare the monthly numbers of cars sold by Marlene and Dwayne during 2008. [2]

- 3 The table shows the probability distribution of the random variable X .

r	10	20	30	40
$P(X = r)$	0.2	0.3	0.3	0.2

- (i) Explain why $E(X) = 25$. [1]
- (ii) Calculate $\text{Var}(X)$. [3]
- 4 A zoologist is studying the feeding behaviour of a group of 4 gorillas. The random variable X represents the number of gorillas that are feeding at a randomly chosen moment. The probability distribution of X is shown in the table below.

r	0	1	2	3	4
$P(X = r)$	p	0.1	0.05	0.05	0.25

- (i) Find the value of p . [1]
- (ii) Find the expectation and variance of X . [5]
- (iii) The zoologist observes the gorillas on two further occasions. Find the probability that there are at least two gorillas feeding on both occasions. [2]
- 5 A pottery manufacturer makes teapots in batches of 50. On average 3% of teapots are faulty.
- (i) Find the probability that in a batch of 50 there is
- (A) exactly one faulty teapot, [3]
- (B) more than one faulty teapot. [3]
- (ii) The manufacturer produces 240 batches of 50 teapots during one month. Find the expected number of batches which contain exactly one faulty teapot. [2]

- 6 In a survey, a sample of 44 fields is selected. Their areas (x hectares) are summarised in the grouped frequency table.

Area (x)	$0 < x \leq 3$	$3 < x \leq 5$	$5 < x \leq 7$	$7 < x \leq 10$	$10 < x \leq 20$
Frequency	3	8	13	14	6

- (i) Calculate an estimate of the sample mean and the sample standard deviation. [4]
- (ii) Determine whether there could be any outliers at the upper end of the distribution. [2]
- 7 A company is searching for oil reserves. The company has purchased the rights to make test drillings at four sites. It investigates these sites one at a time but, if oil is found, it does not proceed to any further sites. At each site, there is probability 0.2 of finding oil, independently of all other sites.

The random variable X represents the number of sites investigated. The probability distribution of X is shown below.

r	1	2	3	4
$P(X = r)$	0.2	0.16	0.128	0.512

- (i) Find the expectation and variance of X . [5]
- (ii) It costs £45 000 to investigate each site. Find the expected total cost of the investigation. [1]
- (iii) Draw a suitable diagram to illustrate the distribution of X . [2]