EXERCISE 23D.2

1 For which of these probability experiments does the binomial distribution apply? Justify your answers, using a full sentence.

- **a** A coin is thrown 100 times. The variable is the number of heads.
- **b** One hundred coins are each thrown once. The variable is the number of heads.
- **c** A box contains 5 blue and 3 red marbles. I draw out 5 marbles, replacing the marble each time. The variable is the number of red marbles drawn.
- **d** A box contains 5 blue and 3 red marbles. I draw out 5 marbles without replacement. The variable is the number of red marbles drawn.
- **e** A large bin contains ten thousand bolts, 1% of which are faulty. I draw a sample of 10 bolts from the bin. The variable is the number of faulty bolts.

2 5% of electric light bulbs are defective at manufacture. If 6 bulbs are tested at random with each one being replaced before the next is chosen, determine the probability that:

- **a** two are defective
- **b** at least one is defective.

3 In a multiple choice test there are 10 questions. Each question has 5 choices, one of which is correct. If 70% is the pass mark and Raj, who knows absolutely nothing about the subject, guesses each answer at random, determine the probability that he will pass.

4 At a manufacturing plant, 35% of the employees work night-shift. If 7 employees are each selected from the entire group at random, find the probability that:

- **a** exactly 3 of them work night-shift
- **b** less than 4 of them work night-shift
- **c** at least 4 of them work night-shift.

5 Records show that 6% of the items assembled on a production line are faulty.
A random sample of 12 items is selected with replacement. Find the probability that:

- **a** none will be faulty
- **b** at most one will be faulty
- **c** at least two will be faulty
- **d** less than four will be faulty.

6 There is a 5% chance that any apple in a crate will have a blemish. If a random sample of 25 apples is taken with replacement, find:

- **a** the probability that exactly 2 of these have blemishes
- **b** the probability that at least one has a blemish
- **c** the expected number of apples that will have a blemish.

7 The local bus service does not have a good reputation. The 8 am bus will run late on average two days out of every five. For any week of the year taken at random, find the probability of the 8 am bus being on time:

- **a** all 7 days
- **b** only on Monday
- **c** on any 6 days
- **d** on at least 4 days.

8 An infectious flu virus is spreading through a school. The probability of a randomly selected student having the flu next week is 0.3.

- **a** Mr C has a class of 25 students.
  - **i** Calculate the probability that 2 or more students will have the flu next week.
  - **ii** If more than 20% of the students have the flu next week, a class test will have to be cancelled. What is the probability that the test will be cancelled?

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1 **a** The binomial distribution applies, as tossing a coin has two possible outcomes (H or T) and each toss is independent of every other toss.

b The binomial distribution applies, as this is equivalent to tossing one coin 100 times.

c The binomial distribution applies as we can draw out a red or a blue marble with the same chances each time.

d The binomial distribution does not apply as the result of each draw is dependent upon the results of previous draws.

e The binomial distribution does not apply, assuming that ten bolts are drawn without replacement. We do not have a repetition of independent trials.

2 **a** ≈ 0.0305 **b** ≈ 0.265 **3** $\approx 0.000\,864$

4 **a** ≈ 0.268 **b** ≈ 0.800 **c** ≈ 0.200

5 **a** ≈ 0.476 **b** ≈ 0.840 **c** ≈ 0.160 **d** ≈ 0.996

6 **a** ≈ 0.231 **b** ≈ 0.723 **c** 1.25 apples

7 **a** ≈ 0.0280 **b** $\approx 0.002\,46$ **c** ≈ 0.131 **d** ≈ 0.710

8 **a** **i** ≈ 0.998 **ii** ≈ 0.807 **b** 105 students