

- 1 An amateur weather forecaster describes each day as either sunny, cloudy or wet. He keeps a record each day of his forecast and of the actual weather. His results for one particular year are given in the table.

		Weather Forecast			Total
		Sunny	Cloudy	Wet	
Actual Weather	Sunny	55	12	7	74
	Cloudy	17	128	29	174
	Wet	3	33	81	117
Total		75	173	117	365

A day is selected at random from that year.

- (i) Show that the probability that the forecast is correct is $\frac{264}{365}$. [2]

Find the probability that

- (ii) the forecast is correct, given that the forecast is sunny, [2]
 (iii) the forecast is correct, given that the weather is wet, [2]
 (iv) the weather is cloudy, given that the forecast is correct. [2]

- 2 A drug for treating a particular minor illness cures, on average, 78% of patients. Twenty people with this minor illness are selected at random and treated with the drug.
- (i) (A) Find the probability that exactly 19 patients are cured. [3]
 - (B) Find the probability that at most 18 patients are cured. [3]
 - (C) Find the expected number of patients who are cured. [1]
- (ii) A pharmaceutical company is trialling a new drug to treat this illness. Researchers at the company hope that a higher percentage of patients will be cured when given this new drug. Twenty patients are selected at random, and given the new drug. Of these, 19 are cured. Carry out a hypothesis test at the 1% significance level to investigate whether there is any evidence to suggest that the new drug is more effective than the old one. [8]
- (iii) If the researchers had chosen to carry out the hypothesis test at the 5% significance level, what would the result have been? Justify your answer. [2]
- 3 A coffee shop provides free internet access for its customers. It is known that the probability that a randomly selected customer is accessing the internet is 0.35, independently of all other customers.
- (i) 10 customers are selected at random.
 - (A) Find the probability that exactly 5 of them are accessing the internet. [3]
 - (B) Find the probability that at least 5 of them are accessing the internet. [2]
 - (C) Find the expected number of these customers who are accessing the internet. [2]

Another coffee shop also provides free internet access. It is suspected that the probability that a randomly selected customer at this coffee shop is accessing the internet may be different from 0.35. A random sample of 20 customers at this coffee shop is selected. Of these, 10 are accessing the internet.

- (ii) Carry out a hypothesis test at the 5% significance level to investigate whether the probability for this coffee shop is different from 0.35. Give a reason for your choice of alternative hypothesis. [9]
- (iii) To get a more reliable result, a much larger random sample of 200 customers is selected over a period of time, and another hypothesis test is carried out. You are given that 90 of the 200 customers were accessing the internet. You are also given that, if X has the binomial distribution with parameters $n = 200$ and $p = 0.35$, then $P(X \geq 90) = 0.0022$. Using the same hypotheses and significance level which you used in part (ii), complete this test. [2]