2 In a certain large college, 22% of students own a car.

(a) 3 students from the college are chosen at random. Find the probability that all 3 students own a car. [1]

$0.22 \times 0.22 \times 0.22 = 0.010648$

(b) 16 students from the college are chosen at random. Find the probability that the number of these students who own a car is at least 2 and at most 4. [3]

$C \sim B(16, 0.22)$

$P(2 \leqslant C \leqslant 4) = P(2) + P(3) + P(4)$

$= {}^{16}C_2 \times 0.22^2 \times 0.78^{14} + {}^{16}C_3 \times 0.22^3 \times 0.78^{13} + {}^{16}C_4 \times 0.22^4 \times 0.78^{12}$

$= 0.631$

3 A company produces small boxes of sweets that contain 5 jellies and 3 chocolates. Jemeel chooses 3 sweets at random from a box.

(a) Draw up the probability distribution table for the number of jellies that Jemeel chooses. [4]

$P(0) = \dfrac{{}^5C_0 \times {}^3C_3}{{}^8C_3} = \dfrac{1}{56}$

0 jellies picked — 3 chocolates picked from 3

$P(1) = \dfrac{{}^5C_1 \times {}^3C_2}{{}^8C_3} = \dfrac{15}{56}$

1 jelly picked from 5 — 2 chocolates picked from 3

$P(2) = \dfrac{{}^5C_2 \times {}^3C_1}{{}^8C_3} = \dfrac{15}{28} \left(= \dfrac{30}{56}\right)$

$P(3) = \dfrac{{}^5C_3 \times {}^3C_0}{{}^8C_3} = \dfrac{5}{28} \left(= \dfrac{10}{56}\right)$

x	0	1	2	3
$P(X = x)$	$\frac{1}{56}$	$\frac{15}{56}$	$\frac{30}{56}$	$\frac{10}{56}$

The company also produces large boxes of sweets. For any large box, the probability that it contains more jellies than chocolates is 0.64. 10 large boxes are chosen at random.

(b) Find the probability that no more than 7 of these boxes contain more jellies than chocolates. [3]

$L \sim B(10, 0.64)$

$P(8) = {}^{10}C_8 \times 0.64^8 \times 0.36^2$

$P(9) = {}^{10}C_9 \times 0.64^9 \times 0.36$

$P(10) = {}^{10}C_{10} \times 0.64^{10}$

$P(L \leqslant 7) = 1 - (P(8) + P(9) + P(10))$

$= 0.759$

2 In a certain country, the probability of more than 10 cm of rain on any particular day is 0.18, independently of the weather on any other day.

(a) Find the probability that in any randomly chosen 7-day period, more than 2 days have more than 10 cm of rain. [3]

$X \sim B(7, 0.18)$

$P(X > 2) = 1 - (P(0) + P(1) + P(2))$

$= 1 - ({}^7C_0 \times 0.18^0 \times 0.82^7 + {}^7C_1 \times 0.18^1 \times 0.82^6 + {}^7C_2 \times 0.18^2 \times 0.82^5)$

$= 0.115$

(b) For 3 randomly chosen 7-day periods, find the probability that exactly two of these periods have at least one day with more than 10 cm of rain. [3]

Probability of at least one day of more than 10cm:

$P(X \geq 1) = P(X > 0)$

$= 1 - P(0)$

$= 1 - {}^7C_0 \times 0.18^0 \times 0.82^7$

$= 0.7507...$

↖ store

$Y \sim B(3, 0.7507)$

$P(Y = 2) = {}^3C_2 \times 0.7507^2 \times 0.2493$

$= 0.421$