1. (a) State one disadvantage of using quota sampling compared with simple random sampling.

(1)

In a university 8% of students are members of the university dance club.

A random sample of 36 students is taken from the university.

The random variable X represents the number of these students who are members of the dance club.

(b) Using a suitable model for X, find

(i) $P(X = 4)$

(ii) $P(X \geqslant 7)$

(3)

Only 40% of the university dance club members can dance the tango.

(c) Find the probability that a student is a member of the university dance club and can dance the tango.

(1)

A random sample of 50 students is taken from the university.

(d) Find the probability that fewer than 3 of these students are members of the university dance club and can dance the tango.

(2)

a) Disadvantage of quota sampling compared with simple random sampling :

⇒ Not random (1)

b) $X \sim B(36, 0.08)$ (1)

(i) $P(X = 4) = 0.167387\ldots$

$= 0.167$ (3 s.f.) (1)

(ii) $P(X \geqslant 7) = 1 - P(X \leqslant 6)$

$= 1 - 0.977\ldots$

$= 0.022233\ldots$

$= 0.0222$ (3 s.f.) (1)

(c) $P(\text{dance club} \cap \text{dance tango}) = 0.08 \times 0.4$

$= 0.032$ (1)

d) let T : dance club and dance tango

$T \sim B(50, 0.032)$ (1)

$P(T < 3) = P(T \leq 2)$

$= 0.785081\ldots$

$= 0.785$ (3 s.f.) (1)

2. Stav is studying the large data set for September 2015

He codes the variable Daily Mean Pressure, x, using the formula $y = x - 1010$

The data for all 30 days from Hurn are summarised by

$$\sum y = 214 \qquad \sum y^2 = 5912$$

(a) State the units of the variable x

(1)

(b) Find the mean Daily Mean Pressure for these 30 days.

(2)

(c) Find the standard deviation of Daily Mean Pressure for these 30 days.

(3)

Stav knows that, in the UK, winds circulate

- in a **clockwise** direction around a region of **high** pressure
- in an **anticlockwise** direction around a region of **low** pressure

The table gives the Daily Mean Pressure for 3 locations from the large data set on 26/09/2015

Location	Heathrow	Hurn	Leuchars
Daily Mean Pressure	1029	1028	1028
Cardinal Wind Direction	NE	E	W (1)

The Cardinal Wind Directions for these 3 locations on 26/09/2015 were, in random order,

W NE E

entire pressure system

You may assume that these 3 locations were under a single region of pressure.

(d) Using your knowledge of the large data set, place each of these Cardinal Wind Directions in the correct location in the table.
Give a reason for your answer.

(2)

1 hPa = 100 Pa , 1 Pa = 1 Nm^{-2}

a) hPa (1)

b) $x = y + 1010$

$\therefore \bar{x} = \bar{y} + 1010$ (1) ← $\bar{x}$ = mean value of x

$= \frac{214}{30} + 1010$

$= 1017.1333 = 1017$ hPa (1)

Question 2 continued.

c) $\sigma_x = \sigma_y$ standard deviation is not affected by this type of coding.

$= \sqrt{\frac{\Sigma y^2}{n} - \bar{y}^2}$ (1)

$= \sqrt{\frac{5912}{30} - \left(\frac{214}{30}\right)^2}$

$= \sqrt{146.1822}$ (1)

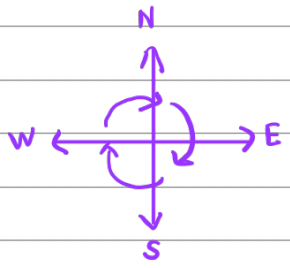
$= 12.0905\ldots = 12.1$ (3 s.f.) (1)

d) mean + standard deviation $\approx 1017 + 12.1$

$= 1029.1$ hPa

∴ entire pressure system is high pressure

so, wind moves in clockwise direction (1)



Locations from North to South: Leuchars, Heathrow, Hurn

- Leuchars (W)
- Heathrow (NE)
- Hurn (E)

- Leuchars (W)
- Heathrow (NE)
- Hurn (E)

(Total for Question 2 is 8 marks)