OCR
Oxford Cambridge and RSA

AS Level Mathematics B (MEI)

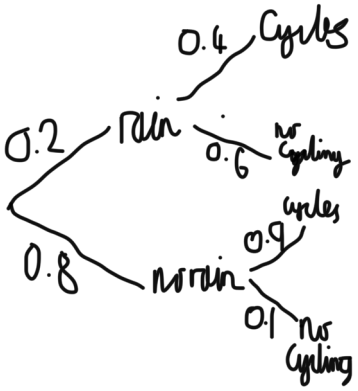
H630/02 Pure Mathematics and Statistics

Question Set 4

1 Each day John either cycles to work or goes on the bus.

- If it is raining when John is ready to set off for work, the probability that he cycles to work is 0.4.
- If it is not raining when John is ready to set off for work, the probability that he cycles to work is 0.9.
- The probability that it is raining when he is ready to set off for work is 0.2.

You should assume that days on which it rains occur randomly and independently.



(a) Draw a tree diagram to show the possible outcomes and their associated probabilities. **[3]**

(b) Calculate the probability that, on a randomly chosen day, John cycles to work. **[3]**

$0.2 \times 0.4 + 0.8 \times 0.9 = 0.8$

John works 5 days each week.

(c) Calculate the probability that he cycles to work every day in a randomly chosen working week. **[2]**

$(0.8)^5 = 0.328$

2 The large data set gives information about life expectancy at birth for males and females in different London boroughs. Fig. 2.1 shows summary statistics for female life expectancy at birth for the years 2012–2014. Fig. 2.2 shows summary statistics for male life expectancy at birth for the years 2012–2014.

Female Life Expectancy at Birth

n	32
Mean	84.2313
s	1.1563
Σx	2695.4
Σx^2	227078.36
Min	82.1
Q1	83.45
Median	84
Q3	84.9
Max	86.7

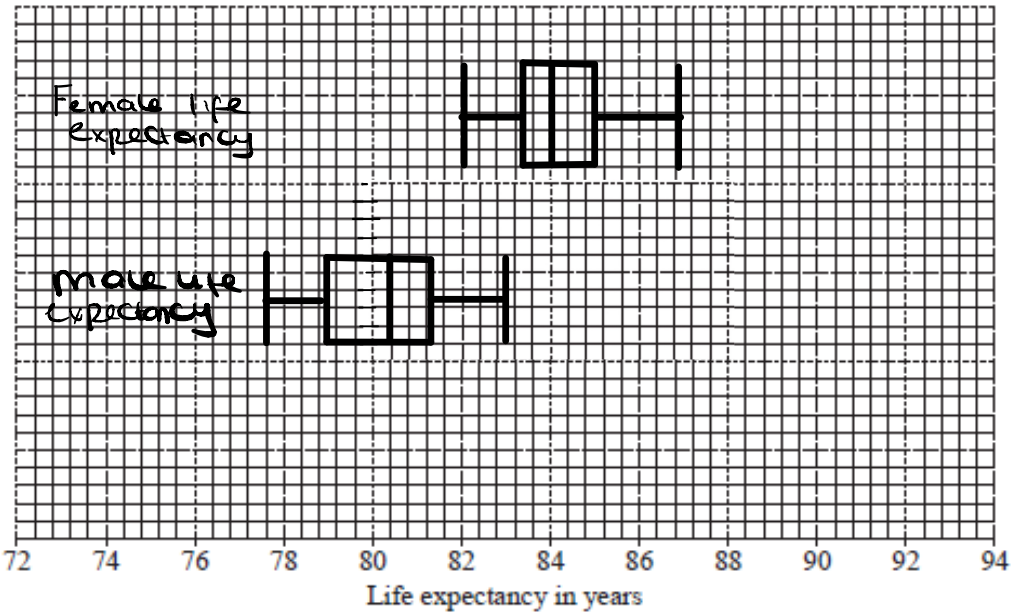
Fig. 2.1

Male Life Expectancy at Birth

n	32
Mean	80.2844
s	1.4294
Σx	2569.1
Σx^2	206321.93
Min	77.6
Q1	79
Median	80.25
Q3	81.15
Max	83.3

Fig. 2.2

Use the information in Fig. 2.1 and Fig. 2.2 to draw two box plots. Draw one box plot for female life expectancy at birth in London boroughs and one box plot for male life expectancy at birth in London boroughs. **[5]**



(b) Compare and contrast the distribution of male life expectancy at birth with the distribution of female life expectancy at birth in London boroughs in 2012–2014. **[2]**

Males lower on average 80.3mean to 84.2. Larger IQR 2.15 to 1.45

Lorraine, who lives in Lancashire, says she wishes her daughter (who was born in 2013) had been born in the London borough of Barnet, because her daughter would have had a higher life expectancy.

(c) Give **two** reasons why there is no evidence in the large data set to support Lorraine's comment. **[2]**

no evidence that Barnet specifically has high life expectancy, data is for all boroughs

no evidence because there is no comparison between Lancashire and Barnet. life expectancies

(d) Use the mean and standard deviation for the summary statistics given in Fig. 2.1 and Fig. 2.2 to show that there is at least one outlier in each set. **[2]**

Male $80.3+1.43=81.7$

$81.7<83.3$

max

Female $=84.2+1.16=85.4<86.7$ max

The scatter diagram in Fig. 2.3 shows male life expectancy at birth plotted against female life expectancy at birth for London boroughs in 2012–14. The outliers have been removed.

Male life expectancy at birth against female life expectancy at birth

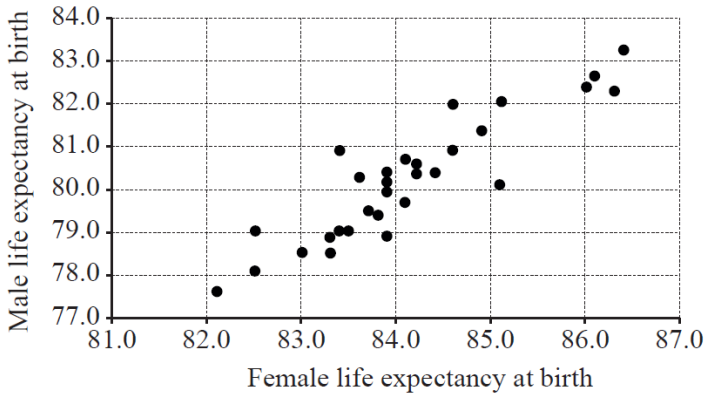


Fig. 2.3

(e) Describe the association between male life expectancy at birth and female life expectancy at birth in London boroughs in 2012–14. **[2]**

positive, as when female LE rises so does male LE

3 According to the latest research there are 19.8 million male drivers and 16.2 million female drivers on the roads in the UK.

(a) A driver in the UK is selected at random. Find the probability that the driver is male. **[1]**

$\frac{19.8}{19.8+16.2}=0.55$

(b) Calculate the probability that there are 7 female drivers in a random sample of 25 UK drivers. **[1]**

$^{25}C_7 \times (0.45)^7 \times 0.55^{18} = 0.0381$

When driving in a built-up area, Rebecca exceeded the speed limit and was obliged to attend a speed awareness course. Her husband said "It's nearly always male drivers who are speeding." When Rebecca attends the course, she finds that there are 25 drivers, 7 of whom are female. You should assume that the drivers on the speed awareness course constitute a random sample of drivers caught speeding.

(c) **In this question you must show detailed reasoning.**

Conduct a hypothesis test to determine whether there is any evidence at the 5% level to suggest that male drivers are more likely to exceed the speed limit than female drivers. **[7]**

$H_0: p = 0.55$

$H_1: p > 0.55$

where p = probability of speeding driver being male

$X \sim B(25, 0.55)$

$P(X \geq 18)$

$= 1 - P(X \leq 17)$

$= 0.0639$

> 0.05

$\therefore$ do not reject H_0

as there is insufficient evidence to support males are more likely to speed

(d) State a modelling assumption that is necessary in order to conduct the hypothesis test in part (c). **[1]**

drivers are independant of each other

Total Marks for Question Set 4: 31 marks