

# 12Ma Statistics Mini Test 02

## Data Representation, Discrete Random Variables

Total 20 marks, 20 minutes

### Question 1

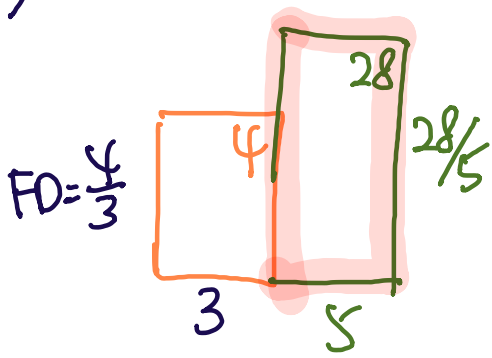
OCR S1 June 2011 Q4 adapted

The table shows information about the time,  $t$  minutes correct to the nearest minute, taken by 50 people to complete a race.

| Time (minutes)   | 28 – 30 | 31 – 35 | 36 – 45 | 46 – 60 |
|------------------|---------|---------|---------|---------|
| Number of people | 4       | 28      | 14      | 4       |

- (a) In a histogram illustrating the data, the height of the block for the 31 – 35 class is 5.6 cm. Find the height of the block for the 28 – 30 class. (3)
- (b) Use linear interpolation to calculate an estimate for the median time. (2)
- (c) Calculate estimates of the mean and standard deviation of the time. (3)
- (d) It was found that the winner's time had been incorrectly recorded and that it was actually less than 27 minutes 30 seconds. Explain, with appropriate reasoning, whether each of the following will increase, decrease or remain the same:
- (i) the mean,
  - (ii) the standard deviation,
  - (iii) the median,
  - (iv) the interquartile range.
- (4)

a)



$$SF: \frac{28}{5} : 5-6$$

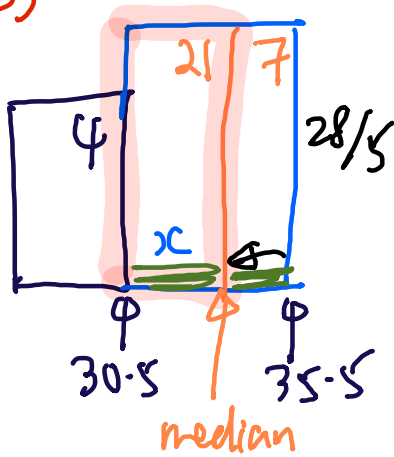
$$1 : 1$$

height of

$$28 - 30$$

$$= \frac{4}{3} \text{ cm}$$

b) 25<sup>th</sup> term








$$30.5 + \frac{21}{\frac{28}{5}} = 34.25 \text{ mins}$$

OR

$$35.5 - \frac{7}{\frac{28}{5}} = 34.25 \text{ mins}$$

# 12Ma Statistics Mini Test 02

## Data Representation, Discrete Random Variables

**1-Variable**  
 $\bar{x}$  = 36.38  
 $\Sigma x$  = 1819  
 $\Sigma x^2$  = 68055.5  
 $\sigma x$  = 6.13234049  
 $s x$  = 6.19459935  
 $n$  = 50

Total 20 marks, 20 minutes

### Question 1

OCR S1 June 2011 Q4 adapted

The table shows information about the time,  $t$  minutes correct to the nearest minute, taken by 50 people to complete a race.

27-5 3 30-5 5 35-5 10 45-5 15 60-5 CW

| Time (minutes)   | 28 – 30 | 31 – 35 | 36 – 45 | 46 – 60 |
|------------------|---------|---------|---------|---------|
| Number of people | 4       | 28      | 14      | 4       |

(a) In a histogram illustrating the data, the height of the block for the 31 – 35 class is 5.6 cm. Find the height of the block for the 28 – 30 class.

(3)

(b) Use linear interpolation to calculate an estimate for the median time.

(2)

(c) Calculate estimates of the mean and standard deviation of the time.

(3)

(d) It was found that the winner's time had been incorrectly recorded and that it was actually less than 27 minutes 30 seconds. Explain, with appropriate reasoning, whether each of the following will increase, decrease or remain the same:

- (i) the mean,  $\downarrow$ , total is lower
- (ii) the standard deviation,  $\uparrow$  this number is more than 15.0 away from mean
- (iii) the median, — position of 25th term is still same
- (iv) the interquartile range, — Q3/Q1 stays the same
- min  $\downarrow$ .

(4)

c)

$$\bar{x} = \frac{\Sigma x}{n} = \frac{1819}{50} = 36.38$$

$$\sigma = \sqrt{\frac{68055.5}{50} - \left(\frac{1819}{50}\right)^2} = 6.13$$

## Question 2

OCR A2 Paper 2 Pure Mathematics and Statistics 2018 Q12 adapted

The discrete random variable  $D$  takes values 1, 2, 3, 4 and 5.  
Its probability distribution is defined as follows.

$$P(D = x) = \begin{cases} a & x = 1, \\ \frac{1}{2}P(D = x-1) & x = 2, 3, 4, 5 \\ 0 & \text{otherwise} \end{cases}$$

where  $a$  is a constant.

(a) Show that  $a = \frac{16}{31}$

$$P(D=1) = a$$

$$P(D=2) = \frac{1}{2}P(D=1) = \frac{1}{2}a$$

$$P(D=3) = \frac{1}{2}P(D=3-1)$$

$$= \frac{1}{2}P(D=2)$$

$$= \frac{1}{2}(\frac{1}{2}a)$$

$$a + \frac{a}{2} + \frac{a}{4} + \frac{a}{8} + \frac{a}{16}$$

$$= 1$$

$$a = \frac{16}{31} \quad (2)$$

The discrete probability distribution for  $D$  is given in the table.

| $x$        | 1               | 2              | 3              | 4              | 5              |
|------------|-----------------|----------------|----------------|----------------|----------------|
| $P(D = x)$ | $\frac{16}{31}$ | $\frac{8}{31}$ | $\frac{4}{31}$ | $\frac{2}{31}$ | $\frac{1}{31}$ |

|     | odd             | even            |
|-----|-----------------|-----------------|
| $P$ | $\frac{21}{31}$ | $\frac{10}{31}$ |

(b) Find the probability that  $D$  is odd.

$$\frac{21}{31}$$

Two independent values of  $D$  are chosen, and their sum  $S$  is found.

(c) Find the probability that  $S$  is odd.

$$1 \otimes 2, 4$$

$$3 \otimes 2, 4$$

$$5 \otimes 2, 4$$

(1)

(d) Find the probability that  $S$  is greater than 8, given that  $S$  is odd.

$$2, 4 \otimes 1$$

$$2, 4 \otimes 3$$

$$2, 4 \otimes 5$$

(2)

(3)

$$\text{odd} + \text{odd} = \text{even}$$

$$\text{odd} + \text{even} = \text{odd}$$

$$\text{even} + \text{odd} = \text{odd}$$

$$\text{even} + \text{even} = \text{even}$$

$$+ \left( \frac{21}{31} \times \frac{10}{31} \right)$$

$$+ \left( \frac{10}{31} \times \frac{21}{31} \right)$$

$$= \frac{420}{961}$$

$$P(A|B)$$

$$= \frac{P(A \cap B)}{P(B)} =$$

$$\frac{\{S > 8\} \cap \{S \text{ is odd}\}}{P(S \text{ is odd})}$$

$$= \frac{\frac{2}{31} \times \frac{1}{31} \times 2}{420/961}$$

$$= \frac{4}{420} = \frac{1}{105} //$$

$$\begin{matrix} 4, 5 \\ 5, 4 \end{matrix}$$