

**Figure 2**

A policeman records the speed of the traffic on a busy road with a 30 mph speed limit.

He records the speeds of a sample of 450 cars. The histogram in Figure 2 represents the results.

(*a*) Calculate the number of cars that were exceeding the speed limit by at least 5 mph in the sample.

**(4)**

(*b*) Estimate the value of the mean speed of the cars in the sample.

**(3)**

(*c*) Estimate, to 1 decimal place, the value of the median speed of the cars in the sample.

**(2)**

(*d*) Comment on the shape of the distribution. Give a reason for your answer.

**(2)**

(*e*) State, with a reason, whether the estimate of the mean or the median is a better representation of the average speed of the traffic on the road.

**(2)**

**Total 13 marks**

**S1 May 2012 qu.5**

The following table summarises the times, *t* minutes to the nearest minute, recorded for a group of students to complete an exam.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Time (minutes) *t* | 11 – 20 | 21 – 25 | 26 – 30 | 31 – 35 | 36 – 45 | 46 – 60 |
| Number of students f | 62 | 88 | 16 | 13 | 11 | 10 |

[You may use ∑f*t*2 *=* 134281.25]

(*a*) Estimate the mean and standard deviation of these data.

**(5)**

(*b*) Use linear interpolation to estimate the value of the median.

**(2)**

(*c*) Show that the estimated value of the lower quartile is 18.6 to 3 significant figures.

**(1)**

(*d*) Estimate the interquartile range of this distribution.

**(2)**

(*e*) Give a reason why the mean and standard deviation are not the most appropriate summary statistics to use with these data.

**(1)**

The person timing the exam made an error and each student actually took 5 minutes less than the times recorded above. The table below summarises the actual times.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Time (minutes) *t* | 6 – 15 | 16 – 20 | 21 – 25 | 26 – 30 | 31 – 40 | 41 – 55 |
| Number of students f | 62 | 88 | 16 | 13 | 11 | 10 |

(*f*) Without further calculations, explain the effect this would have on each of the estimates found in parts (*a*), (*b*), (*c*) and (*d*).

**(3)**

**Total 14 marks**

**S1 May 2013 qu.4**

A midwife records the weights, in kg, of a sample of 50 babies born at a hospital. Her results are given in the table below.

|  |  |  |
| --- | --- | --- |
| **Weight (*w* kg)** | **Frequency (*f*)** | **Weight midpoint (*x*)** |
| 0 ≤ *w <* 2 | 1 | 1 |
| 2 ≤ *w* < 3 | 8 | 2.5 |
| 3 ≤ *w* < 3.5 | 17 | 3.25 |
| 3.5 ≤ *w* < 4 | 17 | 3.75 |
| 4 ≤ *w* < 5 | 7 | 4.5 |

[You may use  = 611.375]

A histogram has been drawn to represent these data.

The bar representing the weight 2 ≤ *w* < 3 has a width of 1 cm and a height of 4 cm.

(*a*)Calculate the width and height of the bar representing a weight of 3 ≤ *w* < 3.5.

**(3)**

(*b*)Use linear interpolation to estimate the median weight of these babies.

**(2)**

(*c*)(i) Show that an estimate of the mean weight of these babies is 3.43 kg.

(ii) Find an estimate of the standard deviation of the weights of these babies.

**(3)**

Shyam decides to model the weights of babies born at the hospital, by the random variable *W*, where *W* ~ N(3.43, 0.652).

(*d*)Find P(*W* < 3).

**(3)**

(*e*)With reference to your answers to (*b*), (*c*)(i) and (*d*)comment on Shyam’s decision.

**(3)**

A newborn baby weighing 3.43 kg is born at the hospital.

(*f*)Without carrying out any further calculations, state, giving a reason, what effect the addition of this newborn baby to the sample would have on your estimate of the

(i) mean,

(ii) standard deviation.

**(3)**

**Total 17 marks**

**S1 June 2016 qu.5**

**Mark scheme**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Scheme** | | **Marks** |
| **5. (a)** | One large square =  or one small square =  (o.e. e.g.) | | M1 |
|  | One large square = 20 cars or one small square = 0.8 cars or 1 car  = 1.25 squares | | A1 |
|  | No. > 35 mph is:  or  (or equivalent e.g. using fd) | | dM1 |
|  | = **90** (cars) | | A1 (4) |
|  |  | |  |
| **(b)** |  | | M1  M1 |
|  | **awrt 28.8** | | A1 (3) |
|  |  | |  |
| **(c)** | (o.e.)  [Allow use of (*n* + 1) giving 195.5 instead of 195] | | M1 |
|  | = 28.125 [Use of (*n* + 1) gives 28.145…] **awrt 28.1** | | A1 (2) |
|  |  | |  |
| **(d)** |  | [Condone ] | B1ft |
|  | So positive skew | [ so (almost) symmetric ] | dB1ft (2) |
|  |  | |  |
| **(e)\*** | [If chose skew in (d)]  **median ()** | [If chose symmetric in (d)]  **mean ()** | B1 |
|  | Since the data is skewed or | Since it uses all the data | dB1 (2) |
|  | median not affected by extreme values |  |  |
|  |  | | **[13]** |

Whole question assesses spec point 1 Numerical measures, graphs and diagrams.

\*Part (e) is AO3

|  |  |  |
| --- | --- | --- |
| **Question** | **Scheme** | **Marks** |
| **4. (a)** |  | B1 |
|  | Mean =  awrt **24.2** or | M1 A1 |
|  |  | M1 |
|  | = 9.293 …..... (accept *s* =9.32) awrt **9.29** | A1 |
|  |  | **(5)** |
| **(b)** | awrt **22.7** | M1 A1 |
|  |  | **(2)** |
| **(c)** | (**\*)** (*n* + 1 gives 18.604…) | B1 cso |
|  |  | **(1)** |
| **(d)** | Q3= 25.5 (Use of *n +* 1 gives25.734…) | B1 |
|  | IQR = 6.9 (Use of *n* + 1 gives 7.1) | B1 ft |
|  |  | **(2)** |
| **(e)** | The data is skewed (condone “negative skew”) | B1 |
|  |  | **(1)** |
| **(f)\*** | Mean decreases and st. dev. remains the same.  [Must mention mean and st. dev.] (from(a)) | B1 |
|  | The median and quartiles would decrease.  [Must refer to median and at least .] ((b)(c)) | B1 |
|  | The IQR would remain unchanged (from (d)) | B1 **(3)** |
|  |  | **[14]** |

Whole question assesses spec point 1 Numerical measures, graphs and diagrams.

\*Part (f) is AO3

|  |  |  |
| --- | --- | --- |
| **Question** | **Scheme** | **Marks** |
| **5. (a)** | Width = **0.5** (cm) | B1 |
|  | e.g. 4 [cm2] represents 8 babies or frequency densities are 8 and 34 | M1 |
|  | Height = **17** (cm) | A1 |
|  |  | **(3)** |
| **(b)** | , or  = awrt **3.47** (allow ) | M1 A1 |
|  |  | **(2)** |
| **(c)(i)** | ,  (\*) | B1 cso |
| **(ii)** | = 0.680147… = awrt **0.680** (accept 0.68) | M1 A1 |
|  |  | **(3)** |
| **(d)** |  | M1 |
|  | = 1 – 0.7454 (tables) | M1 |
|  | = 0.2546 awrt **0.2540.255** | A1 |
|  |  | **(3)** |
| **(e)** | (b) and (c)(i) mean ≠ med or skew or meanmedian or no skew and comment | B1 |
|  | (d) = 0.254 or 0.255 compare data = 0.18 (or 12.7 compared with 9) | B1 |
|  | 0.18 different from 0.25 so normal not good  or 0.18 similar to -.25 so normal is ok | dB1 |
|  |  | **(1)** |
| **(f)\*(i)** | No change in mean (since weight is the same) | B1 |
| **(ii)** | s.d. will decrease (Extra value is at “centre” so data more concentrated) | B1 |
|  | Both statements correct and correct reasons for each | dB1 **(3)** |
|  |  | **[17]** |

Parts (a), (b), (c) and (f) assess spec point 1 Numerical measures, graphs and diagrams.

\*Part (f) is AO3