

Qu 4	Scheme	Marks	AO
(a)	Convenience <u>or</u> opportunity [sampling]	B1	1.2
(b)	Quota [sampling] e.g. Take 4 people every 10 minutes	(1) B1 B1	1.1a 1.1b
(c)	Census	(2) B1	1.2
(d)	[ 58 – 26 =] <b>32</b> (min)	(1) B1	1.1b
(e)	$\mu = \frac{4133}{95} = 43.505263...$ $\sigma_x = \sqrt{\frac{202\,294}{95} - \mu^2} = \sqrt{236.7026...}$ $= 15.385... \text{ awrt } \underline{15.4} \text{ (min)}$	(1) B1	1.1b
(f)	There are outliers in the data (or data is skew) which will affect mean and sd Therefore use median and IQR	M1 A1 (3) B1 dB1	1.1b 1.1b 2.4 2.4
(g)	Value of 20, LQ at 26 and outliers will not change <u>or</u> state that median and upper quartile are the values that <u>do</u> change <u>More values now below 40 than above</u> so $Q_2$ <u>or</u> $Q_3$ will change and be lower Both $Q_2$ <u>and</u> $Q_3$ will be lower	(2) B1 M1 A1 (3)	1.1b 2.1 2.4
<b>(13 marks)</b>			
<b>Notes</b>			
(b)	1 <sup>st</sup> B1 for quota (sampling) mentioned (“Stratified” or “systematic” or “random” are B0B0) 2 <sup>nd</sup> B1 for a description of how such a system might work, requires suitable strata or categories e.g. time slots, departments, gender, age groups, distance travelled etc Suggestion of randomness is B0		
(e)	B1 for a correct mean (awrt 43.5) M1 for a correct expression for the sd (including $\sqrt{\phantom{x}}$ )ft their mean A1 for awrt 15.4 (Allow $s = 15.4667... \text{ awrt } 15.5$ )		
(f)	1 <sup>st</sup> B1 for acknowledging <u>outliers</u> or <u>skewness</u> are a problem for <u>mean and sd</u> “extreme values”/“anomalies” OK May be implied by saying median and IQR not affected by.. We need to see mention of “outliers”, “skewness” and the problem so “data is skewed so use median and IQR” is B0 unless mention that they are not affected by extreme values <u>or</u> mean and standard deviation can be “inflated” by the positive skew etc 2 <sup>nd</sup> dB1 dep on 1 <sup>st</sup> B1 for therefore choosing <u>median and IQR</u>		
(g)	B1 for identifying 2 of these 3 groups of unchanged values or stating only $Q_2$ and $Q_3$ change M1 for <u>explaining</u> that median or UQ should be lower. E.g. the 2 values have moved to below 40 (or 58) and therefore more than 50% below 40 or (more than 75% below 58) <u>or</u> an argument to show that the other 3 values are the same. (o.e.) Allow arrows on box plot provided statement in words about increased % below 40 or 58 etc A1 for stating median <u>and</u> UQ are both lower with clear evidence of M1 scored  [If lots of values on 40 then median might not change but, since two values <u>do</u> change then UQ would change. If this meant that 92 became an outlier then we would have a new value for upper whisker and an extra outlier so effectively 3 values are altered. So median changes]		