



H19-30min Estimating from Samples (Higher): 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** An e-scooter hire company takes a random sample of 65 of the 5200 rides taken in a city last month. 24 of the sampled rides ended with the scooter parked outside a designated bay.
- (a) Work out the percentage of the sample of rides that ended outside a designated bay. Give your answer to 1 decimal place. (2)
- (b) Use the sample to estimate the number of the 5200 rides last month that ended outside a designated bay. (2)

(Total for Question 1 is 4 marks)

- 2** Two market researchers each estimate the mean daily spend of customers at a shopping centre. Researcher A samples 10 customers and gets a mean spend of £42.50. Researcher B samples 200 customers and gets a mean spend of £38.20.
- (a) Write down which researcher's estimate of the mean daily spend is more likely to be reliable. (1)
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- (b) Explain why estimates based on small samples, like Researcher A's, tend to vary more from the true population mean than estimates based on large samples. (2)
- (c) Give the statistical name for the difference between a sample estimate and the true population value that occurs simply because a sample, rather than a census, was used. (1)

(Total for Question 2 is 4 marks)

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- 3** A marine biologist estimates there are 640 turtles nesting on a beach, using the capture-recapture method. In the first catch, she tagged 40 turtles. In the second catch, 32 turtles were caught in total, of which t were already tagged.

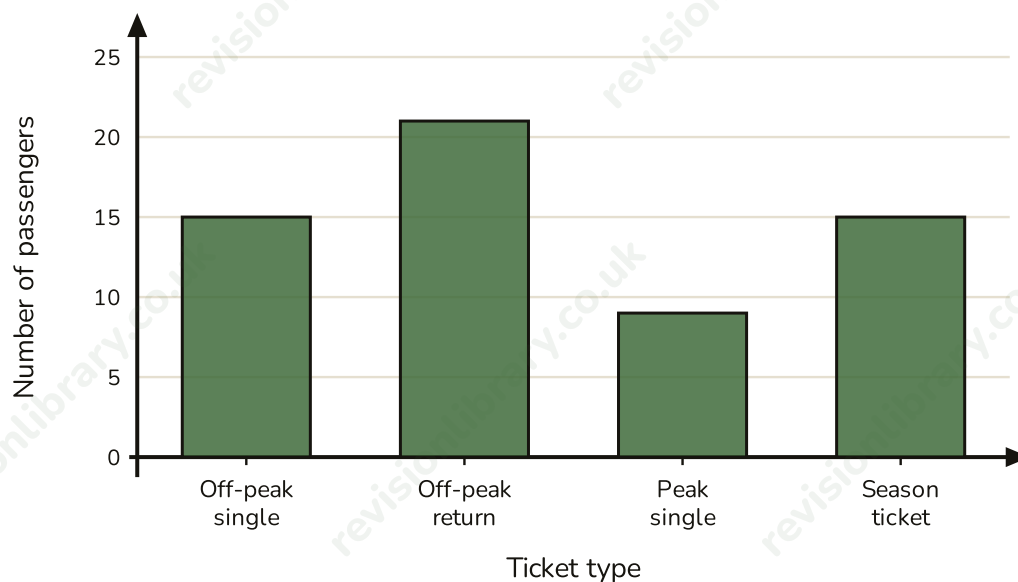
Capture-recapture formula:

estimated population = (number tagged in 1st catch x total in 2nd catch) / (number tagged in 2nd catch)

Work out the value of t .

(Total for Question 3 is 3 marks)

- 4 A rail company surveys a random sample of 60 passengers at a station about which ticket type they bought. The results are shown in the bar chart.



- (a) Write down the number of passengers in the sample who bought a Peak single ticket. (1)
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- (b) Work out the proportion of the sample who bought an Off-peak return ticket. (1)
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- (c) The station has 9020 passengers on a typical weekday. Use the sample to estimate how many of these 9020 passengers buy an Off-peak return ticket. Give your answer to the nearest 10 passengers. (3)

(Total for Question 4 is 5 marks)

- 5** A city council takes stratified samples of residents from two districts to estimate how many residents support a new recycling scheme.

District	Number of residents	Sample size	Number in favour
District A	3000	50	32
District B	5000	80	68

- (a) Use the District A sample to estimate the number of District A's 3000 residents in favour of the scheme. (2)
- (b) Use the District B sample to estimate the number of District B's 5000 residents in favour of the scheme. (2)
- (c) Combine your estimates from (a) and (b) to estimate the total number of residents, across both districts, in favour of the scheme. (1)

(Total for Question 5 is 5 marks)

- 6** A gym recorded the time, in minutes, that a random sample of 100 members spent on cardio machines during one visit. The grouped results are shown in the table.

Time (m minutes)	Frequency
$0 < m \leq 15$	12
$15 < m \leq 30$	28
$30 < m \leq 45$	34
$45 < m \leq 60$	20
$60 < m \leq 75$	6

The gym has 2400 members in total.

- (a)** Use linear interpolation to estimate the median cardio time for this sample. (3)

- (b)** Use your median from part (a) to estimate how many of the gym's 2400 members spend longer than this median time on cardio machines during a visit. (3)

(Total for Question 6 is 6 marks)

- 7** A student is asked to estimate the number of a school's 900 pupils who travel to school by bicycle. A sample of 40 pupils found that 6 travel by bicycle. Here is the student's working:

Proportion who cycle = $6/40 = 0.15$

Estimated number who cycle = $900 / 0.15 = 6000$

- (a)** Identify the error in the student's working, and explain what should have been done instead. (2)
- (b)** Work out the correct estimate for the number of pupils who travel to school by bicycle. (2)

(Total for Question 7 is 4 marks)

Mark scheme · H19-30min Estimating from Samples (Higher): 30-minute Pack

Question 1

- (a) **M1** $24/65 \times 100$, oe
- (a) **A1** 36.9% awrt
- **(a) Answer: 36.9% (awrt)**
- (b) **M1** $24/65 \times 5200$, oe (using the unrounded proportion)
- (b) **A1** 1920 cao
- **(b) Answer: 1920**

Question 2

- (a) **B1** Researcher B cao
- **(a) Answer: Researcher B**
- (b) **B1** a small sample is more strongly affected by a few unusually high or low spenders, so chance variation has a bigger effect on the sample mean, oe
- (b) **B1** as the sample size increases, unusually high and low values are more likely to balance out, so the sample mean settles closer to the true population mean, oe
- **(b) Answer: Small samples are affected more by a few unusual values; larger samples average out this variation, giving estimates closer to the true population mean.**
- (c) **B1** sampling error (or sampling variation) cao
- **(c) Answer: Sampling error**

Question 3

- **M1** $640 = (40 \times 32) / t$, oe (correct equation set up for the unknown t)
- **M1** $t = (40 \times 32) / 640$ ($=1280/640$)
- **A1** 2 cao
- **Answer: $t = 2$**

Question 4

- (a) **B1** 9 cao
- **(a) Answer: 9**
- (b) **B1** $21/60$ oe ($7/20$, 0.35) cao
- **(b) Answer: $21/60$ ($= 7/20$)**
- (c) **M1** $21/60 \times 9020$, oe (ft their proportion from (b))
- (c) **A1** 3157 cao
- (c) **B1** 3160 (correctly rounded to the nearest 10 passengers)
- **(c) Answer: 3160 (nearest 10 passengers)**

Question 5

- (a) **M1** $32/50 \times 3000$, oe
- (a) **A1** 1920 cao
- **(a) Answer: 1920**
- (b) **M1** $68/80 \times 5000$, oe
- (b) **A1** 4250 cao
- **(b) Answer: 4250**
- (c) **B1** 6170 (ft the sum of their (a) and (b)) cao
- **(c) Answer: 6170**

Question 6

- (a) **M1** identifies the median class as $30 < m \leq 45$ (cumulative frequency reaches 50 within this class: cf before = 40, cf after = 74)
- (a) **M1** $30 + (50-40)/34 \times 15$, oe (correct interpolation set up)
- (a) **A1** awrt 34.4 (minutes)
- (a) **Answer: 34.4 minutes (awrt)**
- (b) **B1** recognises that, by definition, half of the (continuous) population lies above the median and half lies below, oe
- (b) **M1** 0.5×2400 , oe
- (b) **A1** 1200 cao
- (b) **Answer: 1200**

Question 7

- (a) **B1** the student divided 900 by 0.15 instead of multiplying 900 by 0.15, oe
- (a) **B1** to scale a sample proportion up to a population, the proportion must be multiplied by the population size (0.15×900), not divided into it, oe
- (a) **Answer: The student divided instead of multiplying; the correct method is 0.15×900 .**
- (b) **M1** 0.15×900 , oe
- (b) **A1** 135 cao
- (b) **Answer: 135**