Question 1

(AQA Level 3 Mathematical Studies)

Worked Solution

(a) Mass on day 0 (the day it was cut):

1925 g

(b) Type of data collected:

Primary and Continuous.

Question 2

(AQA Level 3 Mathematical Studies)

Worked Solution

(a) Length of a stamp:

Continuous — length can take any value in a range.

(b) Number of stamps in his collection:

Discrete — the count can only be a whole number.

(c) Country the stamp is from:

Qualitative — country names are non-numerical categories.

Question 3

(AQA Level 3 Mathematical Studies)

Worked Solution

Flight with 400 passengers: seats 01–10 (first class), 11–70 (business), 71–400 (economy). 80 interviews planned.

(a)(i) Name the sampling method for Method A

Stratified random sampling.

(a)(ii) How were the numbers 2, 12 and 66 calculated?

The sample sizes are proportional to the class sizes:

$$\text{First class: } \frac{10}{400} \times 80 = 2, \quad \text{Business: } \frac{60}{400} \times 80 = 12, \quad \text{Economy: } \frac{330}{400} \times 80 = 66$$

Each stratum sample size $= \dfrac{\text{stratum size}}{400} \times 80$, giving 2, 12 and 66 respectively.

(b) Method B — using random numbers

Number all 400 seats 1 to 400. Use a random number generator (or random number tables) to generate 80 different numbers in the range 1–400. Ignore repeats and any numbers outside this range. The passengers in the seats corresponding to the selected numbers form the sample.

Question 6

(AQA Level 3 Mathematical Studies, Specimen Paper 1, Q1)

Worked Solution

Department store: 130 Sales, 58 Administration, 9 Management. Owner chooses 2 from each area.

(a) Two reasons why this is not a good sample

1. The sample size (6 out of 197) is too small to be representative.
2. The sample is not stratified in proportion to group size — each area provides 2 people regardless of how many staff work there, so Sales (the largest group) is under-represented.

(b) A better sampling method

A stratified random sample of a suitable size (e.g. at least 20) should be used. Number all staff in each department and use random numbers to select from each stratum in proportion to its size:

$$\text{Sales: } \frac{130}{197} \times n, \quad \text{Administration: } \frac{58}{197} \times n, \quad \text{Management: } \frac{9}{197} \times n$$

where n is the chosen sample size.

Question 7

(AQA Level 3 Mathematical Studies, Jun 2016, Paper 1, Q4)

Worked Solution

Year 12: 85 girls, 65 boys.

(a) Is stratified sampling by gender suitable?

Yes, this is a suitable method. The sample is taken in proportion to the number of girls and boys in Year 12, so there will be more girls than boys in the sample — reflecting the actual composition of the year group and making the sample more representative.

(b) How to use random numbers to select the 34 girls

Number all 85 girls from 1 to 85. Use a random number generator or random number tables to select 34 different numbers in the range 1–85. Ignore any repeats or numbers outside this range. The girls assigned those numbers are selected for the sample.

(c) Type of sampling — all girls in the two nearest tutor groups

Cluster (or convenience) sampling.

Question 8

(AQA Level 3 Mathematical Studies, Jun 2017, Paper 1, Q5)

Worked Solution

Carin investigates house prices in London.

(a) How to collect data for her sample

Carin could collect data from estate agents, property websites (e.g. Rightmove or Zoopla), or recent house sales records (e.g. Land Registry) across different areas of London.

(b) Is it sensible to use London data to estimate the average for the rest of England?

No, this is not sensible. London house prices are typically much higher than in other parts of England, so a London sample would not be representative of the rest of England and would overestimate the average house price nationally.

Question 9

(OCR 4768, Jan 2011, Q2a)

Worked Solution

(i) What is stratified sampling? Why is it used?

Stratified sampling divides the population into distinct subgroups (strata) that share similar characteristics. A random sample is then taken from each stratum in proportion to the stratum's size within the population. It is used to ensure the sample is representative of all identifiable subgroups, allowing accurate estimates to be made for each stratum individually.

(ii) Number of households from each tax band (sample of 2000 from 79 368)

$$\text{For each stratum: } \frac{\text{stratum size}}{79\,368} \times 2000$$

$$A\text{–}B : \frac{32298}{79368} \times 2000 \approx 814, \quad C\text{–}D : \frac{33211}{79368} \times 2000 \approx 837$$

$$E\text{–}F : \frac{9739}{79368} \times 2000 \approx 245, \quad G\text{–}H : \frac{4120}{79368} \times 2000 \approx 104$$

A–B: 814, C–D: 837, E–F: 245, G–H: 104.

Question 10

(OCR 4768, Jan 2013, Q4i)

Worked Solution

Random sample of 12 projects from those marked by two examiners.

(i) How should a random sample of projects be chosen?

Number all the projects (this forms the sampling frame). Use a random number generator or random number tables to select 12 different numbers from the range. The projects assigned those numbers form the sample. Ignore repeats.

Question 11

(OCR 4733, Jan 2007, Q2)

Worked Solution

School of 900 pupils, numbered 1–900 alphabetically. Sample method: two dice determine first member; then every 12th.

(i) Size of the sample

The first member is one of 1–12, then every 12th thereafter:

$$\text{Sample size} = 900 \div 12 = 75$$

Sample size = 75.

(ii)(a) Does each pupil have an equal probability of being selected?

True. The first member is equally likely to be any of the numbers 1–12 (the table is constructed so each of the 12 values is equally probable), and once the first member is chosen, all subsequent members are determined. Each pupil has probability 1/12 of being the starting member, so each has probability $1/75 \times 75/900 = 1/900$... more precisely, exactly one in each group of 12 consecutive pupils is always chosen, so every pupil has equal probability $\frac{1}{12}$ of being in the sample position allocated to their group. Each pupil has an equal chance of selection.

(ii)(b) Are the pupils in the sample selected independently?

False. Once the first pupil is selected, all subsequent members of the sample are determined (every 12th pupil thereafter). The selections are not independent of one another.

(iii) Why not just add the two dice scores?

Adding two fair dice scores gives values from 2 to 12, not 1 to 12. Furthermore, the scores are not equally likely (e.g. a sum of 7 is far more probable than a sum of 2), so adding the scores would not give each starting position an equal probability of selection. The table maps dice outcomes to ensure each of the 12 values is equally likely.

End of Worked Solutions