Sampling & Standard Deviation

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1

Some of the people visiting a historic site in Wales signed the visitors' book and left their addresses. The table below shows the frequency distribution of the country of origin of this group of visitors.

Country of origin	Number of visitors
Wales	92
England	64
Scotland	22
Ireland	30
France	12

(a) Advertising material is to be sent to some visitors. A random sample of size 20 stratified on the basis of country of origin is to be selected from the above group of visitors for this purpose. Find the number of people from each of the five countries that should be selected for the sample.

Total visitors = 92+64+22+30+12 = 220

Sample from Wales = $\frac{92}{220} \times 20 = 8.4 = 8$

Sample from England = $\frac{64}{220} \times 20 = 5.8 = 6$

Check sample comes to 20

Sample from Scotland = $\frac{22}{220} \times 20 = 2$

Sample from Ireland = $\frac{30}{220} \times 20 = 2.7 = 3$

Sample from France = $\frac{12}{220} \times 20 = 1.1 = 1$

[5]

(b) Use the following extract from a table of random digits to show how you would select 8 persons from a list of the 92 visitors from Wales for the sample. Explain your method.

34	45	98	78	13	45	03	65	72	39	92
57	06	34	39	08	99	62	29	81	47	11

1. Give each visitor a unique two digit number from 01 to 92.
2. Starting at top left hand digit on table move from left to right selecting pairs of digits.
3. If the pair of digits is within the range and hasn't already been selected, this person is in the sample, otherwise move on.
4. Repeat until 8 persons selected.

[3]

2

Calculate the mean and standard deviation of the following set of 12 numbers.

34, 23, 35, 64, 56, 52, 48, 32, 40, 57, 36, 45

x	34	23	35	64	56	52	48	32	40	57	36	45
x^2	1156	529	1225	4096	3136	2704	2304	1024	1600	3249	1296	2025

$\Sigma x = 522 \quad \Sigma x^2 = 24344$

Mean = $522 \div 12 = 43.5$

$S = \sqrt{\frac{24344}{12} - \left(\frac{522}{12}\right)^2} = \sqrt{136.4} = 11.7$

[3]

1st pair 34 select
2nd pair 45 select
3rd " 98 outside range, reject
4th " 78 select
5th " 13 "
6th " 45 already selected, reject
7th " 03 select
8th " 65 "
9th " 72 "
10th " 39 select and stop.

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3

The table shows the details of the departments in a computer company.

Department	Number of people employed
Management	36
Sales staff	182
Software technicians	62
Hardware engineers	48
Administration assistants	30

A stratified random sample of the people employed is to be selected to form a committee. Calculate the number of people from each department who should be selected to form a committee of size 20.

N° of employees = 36 + 182 + 62 + 48 + 30 = 358

Sample from Management = $\frac{36}{358} \times 20 = 2.01 = 2$

Sample from Subs = $\frac{182}{358} \times 20 = 10.2 = 10$

" " Software = $\frac{62}{358} \times 20 = 3.46 = 3$

" " Hardware = $\frac{48}{358} \times 20 = 2.7 = 3$

" " Admin = $\frac{30}{358} \times 20 = 1.7 = 2$

20 ✓

Complete the table below.

Department	Number of people on the committee
Management	2
Sales staff	10
Software technicians	3
Hardware engineers	3
Administration assistants	2

[4]

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4.

(a) The English test marks scored by 10 pupils in a test were as follows:

x	26	34	56	86	24	72	63	56	82	48

Calculate the mean and standard deviation of the 10 test marks.

x^2 676, 1156, 3136, 7396, 576, 5184, 3969, 3136, 6724, 2304

$\Sigma x = 547$ $\Sigma x^2 = 34257$

Mean = $547 \div 10 = 54.7$

$S = \sqrt{\frac{34257}{10} - \left(\frac{547}{10}\right)^2} = \sqrt{433.61} = 20.8$

[3]

(b) Marks are added for spelling, punctuation and grammar. In this case two marks were added to each pupil's test mark. State the new mean and standard deviation for the test results. Give a reason for your answer.

Because 2 marks have been added to all pupils, the mean will increase by 2 to 56.7 but the spread of the data will be the same so $S = 20.8$ still.

[3]