

1. a) We have a total of 1200 pupils on school roll
assign each of them with a unique no. from 1 to 1200.

Then generate 100 distinct random numbers, using an appropriately seeded random number generator,
between 1 and 1200 inclusive.

These 100 numbers identify the members of the sample to use.

- b) The 100 people need to be taken in proportion to the size of the year group

Year	1	2	3	4	5	6	Total
Roll	290	285	310	175	92	48	1200
Sample	24.1	23.8	25.8	14.6	7.7	4	100 $\div 12$
Rounded	24	24	26	15	8	4	101
Sampled:	24	24	26	14	8	4	100

rounded 15 to 14 as 14.6 was lowest decimal part to round down.

So we shall sample 24 from Year 1, 24 from Year 2, 26 from Year 3, etc

For each year group, process is similar to part (a) in that you generate the required number of random nos. from 1 to the number of pupils in a year group. With each pupil in the year group numbered uniquely from 1 to the no. in each year group, we can identify those in each sample, for each year group.

2. a) now $\frac{500}{25} = 20$

so, for systematic sampling, we need to take every 20th employee from the works number list. we need to also generate a single random number from 1 to 19 inclusive, to be the first person selected. Thereafter take every 20th person.

This will generate a sample of size 25.

b) if the Works numbers are unique from 1 to 500, simply generate 25 unique random numbers from 1 to 500 inclusive using a suitably seeded random number generator.

These 25 nos. are the works numbers of those required in the sample.

c) a random sample could be generated without random numbers in a similar way to lottery or Football draws are made. Put 500 uniquely numbered balls in a large box. Mix them up thoroughly. Take out 25 balls - these are the members of your sample.

3.

Method 1

This would not be random.

However, it might make the most business sense to do!

Method 2

This would be random.

This process would not be guaranteed to locate any fraudulent claims

Method 3

This would be random, but would increase the chance of certain numbered claims being selected. As the largest 2 digit number is 99, then 0-41 and 42-83 would generate 0-41 with equal likelihood. However 84-99 gives claims numbered 0-15 an extra chance to be selected.

Therefore this selection method is biased to claims 0-15.

Method 4

This modified method removes the bias in Method 3.

Hence this would be random, but - as with Method 2 - still not guaranteed to locate any claims that would benefit from investigation.

Method 5.

This is systematic sampling which would yield a random sample.

This might be appropriate to use if the 42 claims were numbered in the order that they were received, and thus the sample spans the full time-line, not favouring those who claimed first, or last.

4.

Age	0-4	5-14	15-44	45-64	65+	Total
People	14	41	50	70	14	189
						40 $\downarrow \div 4.725$
Theory Sample	2.9	8.7	10.6	14.8	2.9	
	\downarrow_{up}	\downarrow_{up}	\downarrow_{down}	\downarrow_{up}	\downarrow_{up}	
Actual Sample	3	9	10	15	3	40

So we'd aim to take samples of size 3, 9, 10, 15, 3 from each age group

By way of example, for age group 0 to 4, number the 14 people from 1 to 14 inclusive.

Generate 3 unique random numbers from 1 to 14, using an appropriately seeded random number generator.

These 3 nos. are the sample of 3 taken from the 0-4 age group.

Repeat this process for the other 4 age groups.

5. random sample : each member of the population has an equal chance of being selected.

Random samples inherently have no bias

Non-random samples can induce bias into a sample, and it can be hard to design quotas accurately to overcome this.

Stratified sampling - a random sampling process whereby each member of each strata has equal chance of being selected.

Quota sampling - a non-random sampling process whereby the sample is assembled in line with predefined quantities of categories.

Quota sample has an advantage over Stratified Sampling by way of often being quicker (and thus less costly) to perform.

Method A

This random process involves a lot of manpower and will be very time consuming to complete. It is also quite intrusive from the patients' perspective.

Method B.

This process would include members of the public who may not have had any dealings with the hospital. It also avoids making contact with those people who are not listed in phone directories.

Many people will be reluctant to give views over the phone after being 'cold-called'

Method C

Again, you may get responses from non-hospital patients.

Typically these methods can have a poor return rate, but the prepaid envelopes will help in this respect. Also, questionnaires can be completed at the recipients' leisure.

Finally, you may only hear from those who have strong views on the issue.

b) I would advise none of the above methods, as they stand. I would go for a method that merges A & C (i.e. send postal questionnaires to previous patients). I would also consider including an incentive for them to return questionnaire (i.e. donation to charity per completed survey form)