Random sampling

Selecting packages at random either by:

- **Number**; not from the production line, or

- **Time**; from the production line

First determine the **inspection lot size** and the **sample size**

Random sampling

Determine the **inspection lot size** (**N**)

- From production line at the packer; use **max hourly output** figure

- Not from production line at the packer; use **max hourly output** figure or **100,000** (whichever is lesser)

Random sampling

Determine the **inspection lot size** (*N*)

- Not from the packer, unknown max hourly output and unknown lot size; **LMO discretion**, but no more than 100,000

- Generally the legal metrology official should take the number of prepackages **available** as the inspection lot size

Random sampling

Determine the **sample size** (*n*)

Inspection lot size *N*	Sample size *n*
20 or less	Total inspection
40	32
60	35
80	47
100	49

Inspection lot size *N*	Sample size *n*
200	64
300	67
400	81
500	81
600 to 100 000	98

Remember detailed sampling plans in Annex I

Random sampling

Choosing a random sample not collected from the production line:

- Pallets and pallets of product

Random sampling

'**Mechanical**' method

- Start by allocating a reference number to each prepackage in the inspection lot

Random sampling

1. '**Drawing cards from a hat**'

- Record the numbers allocated to the individual prepackages in some physical way i.e. on cards, slips of paper etc

- After thoroughly mixing, choose as many cards etc. as there are prepackages needed for the sample

- The corresponding prepackages of the inspection lot will then make up the sample

Random sampling

2. **Random number tables**

- Any position in the table has a probability of 0.1 of being occupied by any particular digit

- Select a starting point by using a random procedure

  - For example, use Table 1 on a Monday, Table 2 on a Tuesday etc

  - Then stab the page with a pin to begin

- Start taking random digits top to bottom & left to right or vice versa

Random sampling

2. Random number tables

- For a lot containing up to 999 pre-packages use 001, 002, ….999

- Ignore any triplet outside the sample size range

- Similarly for lot sizes between 1000 and 9999 use four digit numbers

Random sampling

3. Random number generation using excel

An excel spreadsheet can generate random numbers by using function "**=RANDBETWEEN(low,high)**"

- **low** being 0, and

- **high** being the number of prepackages in the inspection lot

Random sampling

4. Random number generation using a calculator

Many calculators can generate random numbers between 0.000 and 0.999 inclusive

Random sampling

Worked example:

- To choose a random sample of 49 prepackages from a lot size of 100 (**R 87 Table 2**)

- **Allocate** each of the 100 packages in the lot their own reference number i.e. 1, 2….100

- Generate a random sequence of numbers (as per previous slides)

Random sampling

Worked example:

49 randomly generated numbers from 1 to 100

5	6	99	1	68	91	84	89	61	79
86	69	26	49	11	22	72	50	80	97
92	77	10	24	8	95	32	25	29	18
67	55	4	19	9	37	2	41	33	52
45	38	30	47	13	7	14	21	43	

Random sampling

Worked example:

In numerical order for convenience

1	7	13	22	30	41	50	68	80	92
2	8	14	24	32	43	52	69	84	95
4	9	18	25	33	45	55	72	86	97
5	10	19	26	37	47	61	77	89	99
6	11	21	29	38	49	67	79	91	■

Random sampling

Choosing a random sample from the production line:

- Reference test completed using samples taken from 1 hour of production

- Lot size will equal the total hourly output of the production line

- Each sample to be taken is given a random time

- Take the samples after the point of final checks by the packer from the production line

- Remember to stop the clock when production stops

Random sampling

Random sampling

Choosing a random sample from the production line procedure:

- Divide the hour into 3600 seconds

- Choose the random times in the range from 0001 to 3600 for the required sample size

- Use one of the 4 methods explained previously:

  - Drawing cards from a hat
  - Generate from excel

  - Random number tables
  - Generate from a calculator

Random sampling

- The following sequence of numbers would produce the corresponding times throughout the hour:

  - 1287 = 21 min 27 sec

  - 1936 = 32 min 16 sec

  - 1677 = 27 min 57 sec
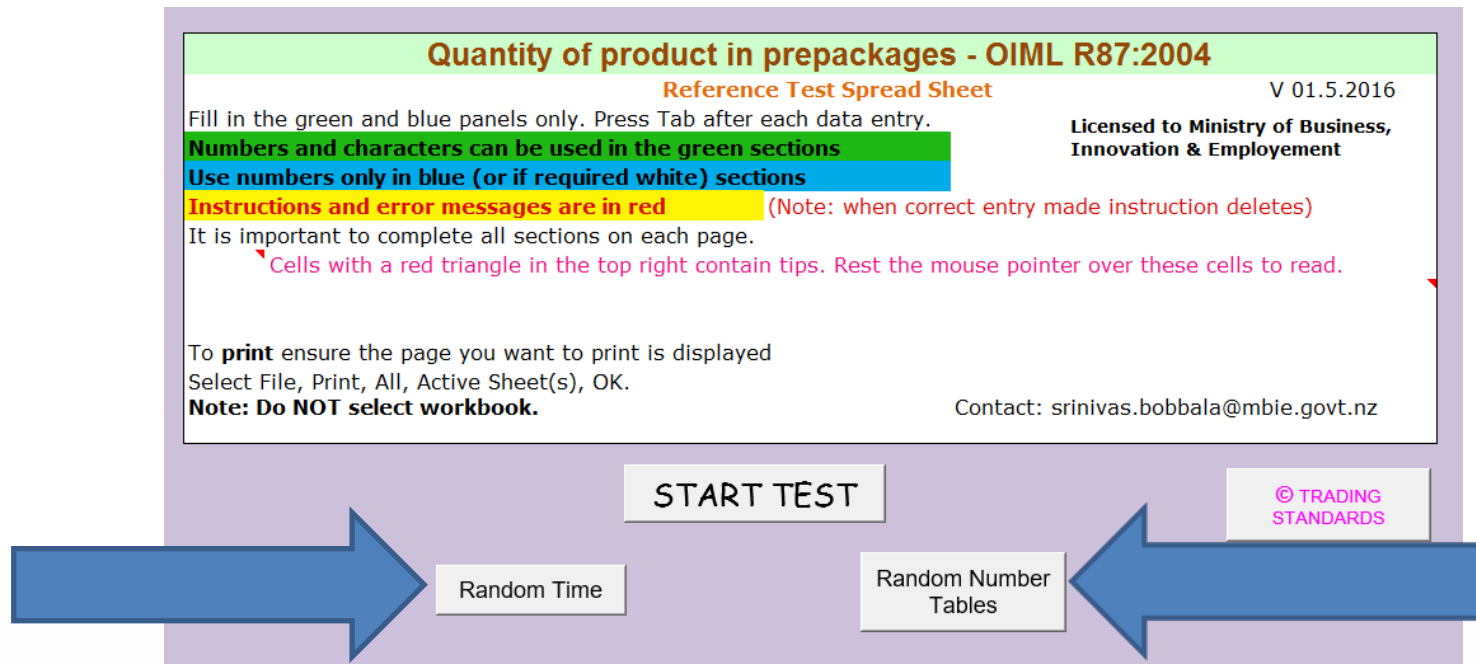
  List your times into chronological order and begin taking the required samples

Random sampling

- Now that you have possession of the samples you are another step closer to being able to complete the reference test

- Ps there is good news on the next slide…

Random sampling

- The excel R 87 template has an inbuilt random number and time generator