Preparing for Employers' Numerical Tests

November 2014

Resources : Elementary mathematics/statistics

There are many books available that cover the level of mathematics required of these tests. Two in particular are:

- "*Refresher in Basic Mathematics*", by Nick Rowe and published by CENGAGE Learning EMEA.
- "*Improve Your Numeracy*", developed by the University of Birmingham Careers Centre. Available through the Math Centre website at:

  http://www.mathcentre.ac.uk/resources/Refresher%20Booklets/numeracy%20refresher/mathcentreNumeracy1.pdf

These cover similar ground, but there is a slight difference in emphasis between each of them.

For Statistics, a well-renowned, and non-technical, book is:

- "*How To Lie With Statistics*", by Darrell Huff and published by Penguin Business.

Resources : Testing

There are numerous books available on testing, and how to prepare for them. When finding one for you, consider the level of your own skills and your target employers. Additionally, consider the type of tests you will be sitting.

The following titles are ones used by previous LSE students:

- "*How To Pass Numeracy Tests*", by Harry Tolley and Ken Thomas. Published by Kogan Page.

- "*How To Pass Advanced Numeracy Tests*", by Mike Bryon. Published by Kogan Page.

These cover similar ground, but there is a slight difference in emphasis between each of them.

Resources : Websites

Many firms provide examples of tests, and you will find that different sites are more appropriate for certain industries/sectors than others. Examples include:

- Cubiks
- Cut-E
- Kenexa
- SHL
- Saville
- Talent Q

If you use these sites, make sure they are relevant to your requirements.

The website AssessmentDay.co.uk contains a nice summary of which industries tend to use tests from these, and other, companies.

Resources : Websites

In addition to these, there are many sites that offer practice tests.

The following list includes some examples which have helped me prepare for this talk. There are many others.

- PracticeAptitudeTests.com
- University of Kent Careers and Employability test
- AssessmentDay.co.uk
- GraduateWings.co.uk

For *harder* tests (which are more aligned to the sort of tests that many consultancy firms and investment banks use), you can find several sample tests and solving tips at McKinsey.com:

- Interview prep advice at McKinsey.com
- For another case study, search for 'Kosher Franks'

Resources : LSE resources

You will find a wealth of information on the LSE Careers Service website at:

http://www.lse.ac.uk/intranet/CareersAndVacancies/careersService/Home.aspx

In particular, they offer some material relating to Psychometric Tests:

http://www.lse.ac.uk/intranet/CareersAndVacancies/careersService/IntsAssessPsych/Psychometrics/Home.aspx

This includes a list of resources to employers' sites, testing firms and sample tests:

http://www.lse.ac.uk/intranet/CareersAndVacancies/careersService/IntsAssessPsych/Psychometrics/Resources.aspx

In addition to these, there are various useful resources to be found on the Teaching and Learning Centre's **Learning World** site on Moodle:

https://moodle.lse.ac.uk/course/view.php?id=698

What topics will I need to know

The level of mathematics required for many of these tests is usually not greater than GCSE, but this will of course vary depending on the industry and job you are applying for, so **check before** and **prepare accordingly**!

Having said that, you should certainly expect the following topics to arise:

- Addition / Subtraction
- Multiplication / Division
- Percentages / Ratios

Many tests may also expect you to be able to read and interpret graphs such as:

- Line plots
- Histograms
- Scatter plots.

Solving problems

The mathematician George Polya published the book '*How To Solve It*' in 1945, in which he outlined a general approach to solving mathematical problems.

This method is still being promoted today as a good way for practising mathematicians (from student to researcher) to approach problems.

1) Understand the problem. *Read the question at least once, preferably twice.*

2) Devise a plan. *Typically, make a decision: True or false? Larger or smaller? Etc...*

3) Carry out the plan. *Here you may choose to estimate to simplify and speed things up.*

4) Review. *Is your answer correct? Sensible? Expected?*

See the Teaching and Learning Centre's Study Toolkit for more on this.

Mathematical tips

Mathematicians frequently use three very general approaches to problem-solving:

- Given a problem to solve, try to connect it to another problem which you already understand.
- Look for quick or brief methods of tackling a problem, rather than slow or lengthy ones.
- Look for ways of extending a technique to a new situation.

In subsequent slides, we shall consider more specific ways that are relevant to employers' tests.

Easy numbers – Calculations without a calculator

Some calculations, such as multiplications, can be done without the use of a calculator.

For example, consider multiplication by 10

10 x a whole number	10 x a decimal fraction
Add one 0 on the right	Move the decimal point one place to the right.
10 x 1234 = 12340	10 x 12.34 = 123.4

Easy numbers – Calculations without a calculator

Some calculations, such as multiplications, can be done without the use of a calculator.

Now consider multiplication by 100

100 x a whole number	100 x a decimal fraction

Easy numbers – Calculations without a calculator

Some calculations, such as multiplications, can be done without the use of a calculator.

Now consider multiplication by 100

100 x a whole number	100 x a decimal fraction
Add **two** 0's on the right	
100 x 1234 = 123400	

Easy numbers – Calculations without a calculator

Some calculations, such as multiplications, can be done without the use of a calculator.

Now consider multiplication by 100

100 x a whole number	**100 x a decimal fraction**
Add **two** 0's on the right	Move the decimal point **two** places to the right.
100 x 1234 = 123400	100 x 12.34 = 1234.0

In fact, this can be seen as an *extension* of our method for multiplying by 10.

Easy numbers – Calculations without a calculator

We can extend this further to cases that my be less immediately obvious.

For example, how could you easily multiply by 50?

Easy numbers – Calculations without a calculator

We can extend this further to cases that my be less immediately obvious.

For example, how could you easily multiply by 50?

Rather than using long multiplication, consider:

1) Multiplying by 100, i.e.

$$100 \times 1234 = 123400$$

2) Then dividing by 2, i.e.

$$123400 / 2 = 61700$$

Easy numbers – Calculations without a calculator

We can extend this further to cases that my be less immediately obvious.

For example, how could you easily multiply by 50?

How could you easily multiply by 25?

How could you easily multiply by 75?

Percentages

Suppose that the rate of sales tax is 20%, and that the total, i.e. *gross*, price paid for a particular product is £96.

What is the *net* price of the product, i.e. the price excluding sales tax?

A	B	C	D	E
£76.8	£80	£96	£115.20	£120

Looking for Patterns

Consider the following sequences of numbers and try to identify the underlying patterns.

What are the next entries in each of the sequences?

1, 4, 9, 16, ??

1, 3, 6, 10, ??

1, 4, 10, 20, 35, ??

Looking for Patterns

Be careful!

- The obvious answer is not always the right answer.
- If there is information in a question that you have not used, **CHECK** before deciding if you have answered the question completely.
- There are infinitely many formulae for both the sequences, though in each case one is obviously simpler than all the others.

Example: Population Structure 1985

	Population at start of year (million)	Live births per 1000 population (Jan-Dec)	Deaths per 1000 population (Jan-Dec)	Percentage of population at start of year aged:	
				Under 15	60 or over
UK	56.6	13.3	11.8	19	21
France	55.2	13.9	10.0	21	19
Italy	57.1	10.1	9.5	19	19
Germany	61.0	9.6	11.5	15	20
Spain	38.6	12.1	7.7	23	17

1. Which country had the highest number of people aged 60 or over at the start of 1985?

A	B	C	D	E
UK	France	Italy	Germany	Spain

See solution

Example: Population Structure 1985

	Population at start of year (million)	Live births per 1000 population (Jan-Dec)	Deaths per 1000 population (Jan-Dec)	Percentage of population at start of year aged:	
				Under 15	60 or over
UK	56.6	13.3	11.8	19	21
France	55.2	13.9	10.0	21	19
Italy	57.1	10.1	9.5	19	19
Germany	61.0	9.6	11.5	15	20
Spain	38.6	12.1	7.7	23	17

2. How many live births occurred in 1985 in Spain and Italy together (to the nearest 1,000)?

A	B	C	D	E
104,000	840,000	1,044,000	8,400,000	10,440,000

See solution

Example: Population Structure 1985

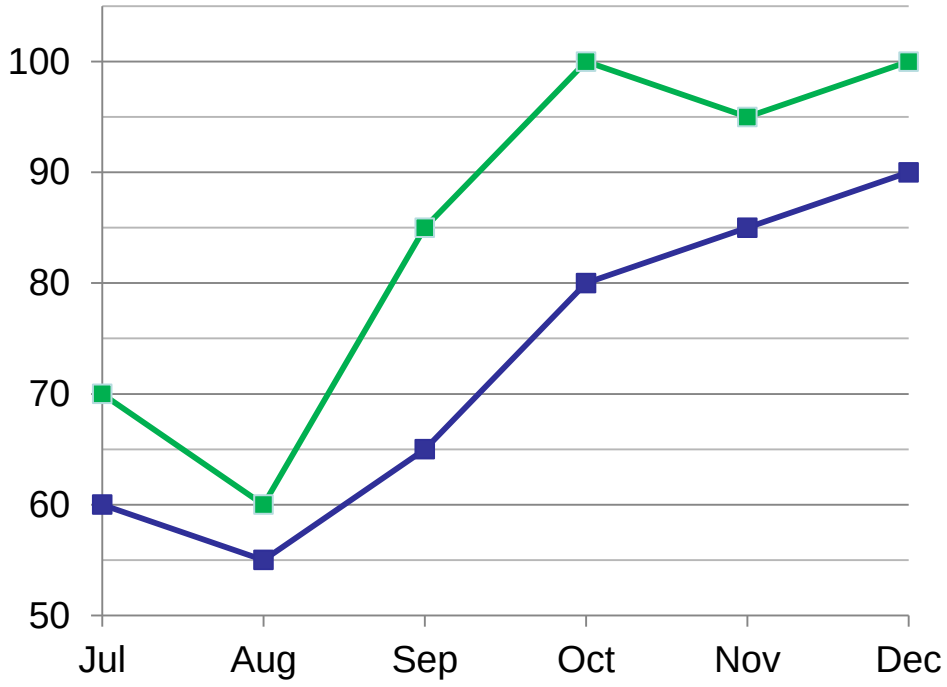
	Population at start of year (million)	Live births per 1000 population (Jan-Dec)	Deaths per 1000 population (Jan-Dec)	Percentage of population at start of year aged:	
				Under 15	60 or over
UK	56.6	13.3	11.8	19	21
France	55.2	13.9	10.0	21	19
Italy	57.1	10.1	9.5	19	19
Germany	61.0	9.6	11.5	15	20
Spain	38.6	12.1	7.7	23	17

3. What was the net effect on the UK population of the live birth and death rates in 1985?

A	B	C	D	E
Decrease of 66,700	Increase of 84,900	Increase of 85,270	Increase of 752,780	Cannot say

See solution

Example: Production of 15mm Buttons, July – December



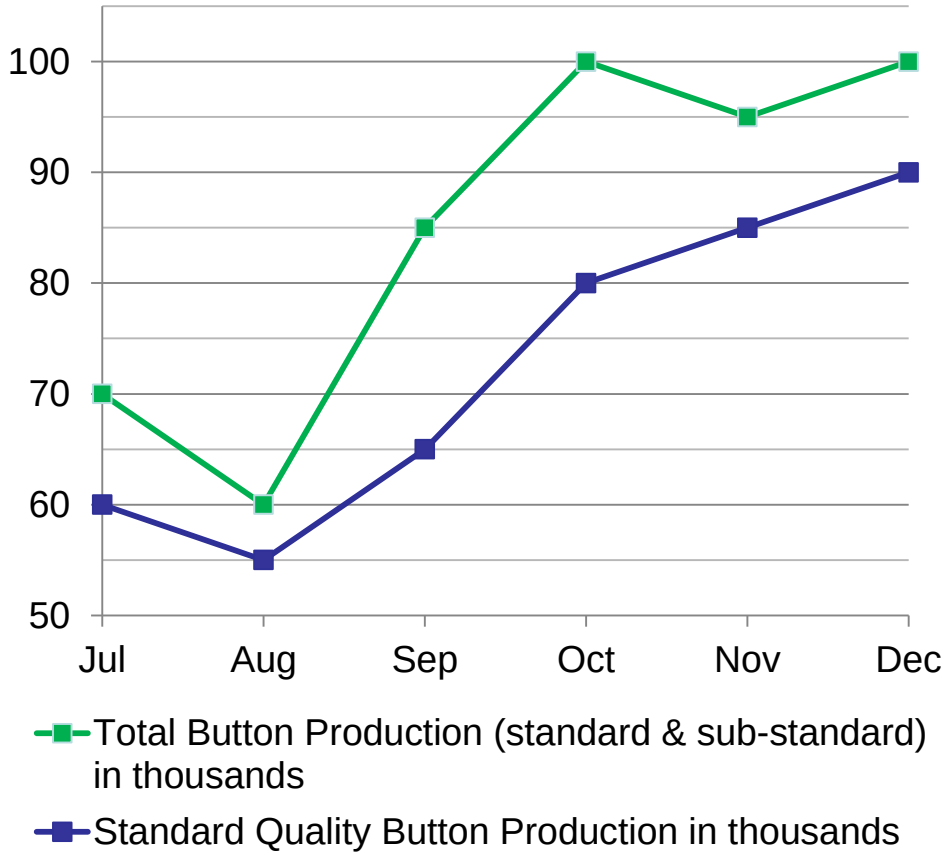
Sales price (per 100 buttons)	
Standard quality buttons	£5.70
Sub-standard quality buttons	£2.85

4. What percentage of the total 15mm button production was classed as sub-standard in September?

A	10.5 %
B	13 %
C	15 %
D	17.5 %
E	20 %
F	23.5 %
G	25 %
H	27.5 %
J	28 %
K	30.5 %

See solution

Example: Production of 15mm Buttons, July – December



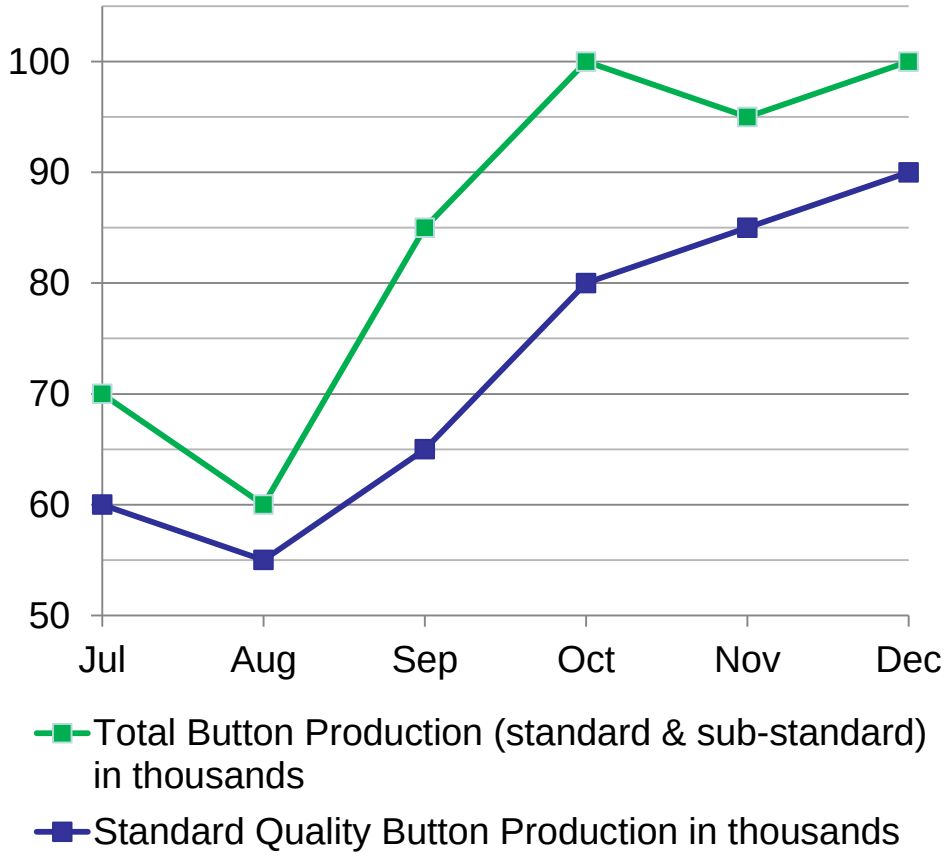
Sales price (per 100 buttons)	
Standard quality buttons	£5.70
Sub-standard quality buttons	£2.85

5. By how much did the total sales value of November's button production vary from October's?

A	£28.50
B	£142.50
C	£285.00
D	£427.50
E	No change

See solution

Example: Production of 15mm Buttons, July – December



Sales price (per 100 buttons)	
Standard quality buttons	£5.70
Sub-standard quality buttons	£2.85

6. What was the loss in potential sales revenue attributable to the production of sub-standard (as opposed to standard) buttons over the 6 month period?

A	£213.75
B	£427.50
C	£2,137.50
D	£2,280.00
E	£4,275.00

See solution

General tips

- **Don't panic!** There is a lot of help available to you.

- Practice a lot.
  - Work with friends and peers to gain different insights into tests.
  - Work by yourself to help focus and identify your strengths / weaknesses.

- Seek guidance or help.
  - From online or printed resources already mentioned.
  - From teaching support such as your class teachers or the TLC.

- Try to do any exercises *without* using a calculator (other than your brain).
  - This will help you to understand the underlying logic much better.
  - Also note that some tests do not allow the use of calculators (or only specific ones).

Solutions

Percentages

The original price before sales tax is £80.

Looking for patterns

The first pattern is simply the squares of the whole numbers from 1 upwards. The next entry we therefore expect to be 25.

The second pattern is the sum of the first *n* whole numbers, for *n* = 1, 2, etc. The next entry we therefore expect to be 15.

The third pattern is related to the second one above. Consider the differences between consecutive entries. The next entry we expect to be 56.

Population structure

1. D 2. C 3. B

Production of 15mm buttons, July – December

4. F 5. E 6. C