



6-10 questions

2. Types and Sources of Data

Primary data

Secondary data

Discrete data

- Number of days it has rained

Continuous data

- The amount of rainfall

5. Summary Statistics

Mean and standard deviation

Mean (central tendency)

$$\bar{X} = \frac{\sum X}{n}$$

Standard deviation (measure of dispersion)

$$\sigma_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Variance is simply standard deviation squared

Further information

Populations and samples

Population – where the entire set of data is collected. Can be difficult in many circumstances.

Sample – a set of data that represents the population.

Random sample – every item has an equal chance of selection

Non-random sampling includes:

- **Quota sampling** – a sample up to a given number
- **Stratified sampling** – structuring the data in the quota to represent the population, e.g. 520 women and 480 men.
- **Convenience sampling** – the easiest to collect
- **Judgement sampling** – choosing that which best represents the population
- **Snowball sampling** – choosing through referrals. Typically used for where the subjects of data are rare.



5. Summary Statistics

Mean and standard deviation

Using the FX83GT to calculate the standard deviation and the mean:

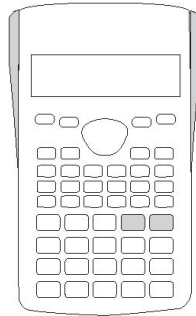
Example: 23 45 16 12 17 -7 28

- Stats mode: MODE 2 then 1
23 = 45 =

- Mean**
Casio FX83GT: AC then SHIFT 1 then 4 then 2 =

- Standard deviation (population)**
SHIFT 1 then 4 then 3 =

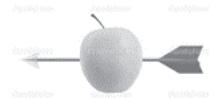
- Standard deviation (sample)**
SHIFT 1 then 4 then 4 =



Keeping on target

The returns from a sample of 5 funds in the City of London are 12%, 7%, 15%, 22% and 9% p.a. Calculate the standard deviation of returns of firms in the square mile.

- A. 5.25
- B. 5.87
- C. 34.5
- D. 27.6



Keeping on target

Saliy has 7 shares. Each of the shares produced the following returns 9%, 10%, 6%, 8%, 14%, 13% and 9% p.a. What was the standard deviation of returns from the shares held by Saliy?

- A. 2.6
- B. 2.8
- C. 7.8
- D. 6.8



5. Summary Statistics

Mean and standard deviation

Calculating the mean and variance of the following sample:

1, 5, 9, 24, 37, 54

Answer to the questions on the previous slide:

B

Std Dev of sample: 5.87

A

Std Dev of population: 2.6

5. Summary Statistics

Geometric mean

Calculates the **average compound rate**, or the **average rate of return**.

$$G = \sqrt[n]{(1+x_1) \times (1+x_2) \times \dots \times (1+x_n)} - 1$$

Example: A principal amount is invested for three years and achieves the following annual rates of return:

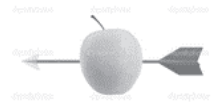
- Year 1: 30%
- Year 2: -25%
- Year 3: 40%

Calculate the average growth rate

Keeping on target

The returns on one City of London fund over the last 5 years have been 12%, 7%, -15%, 22% and 9% p.a. The geometric mean is closest to:

- A. 1.06%
- B. 6.00%
- C. 6.26%
- D. 7.00%



5. Summary Statistics

Mode and range

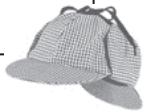
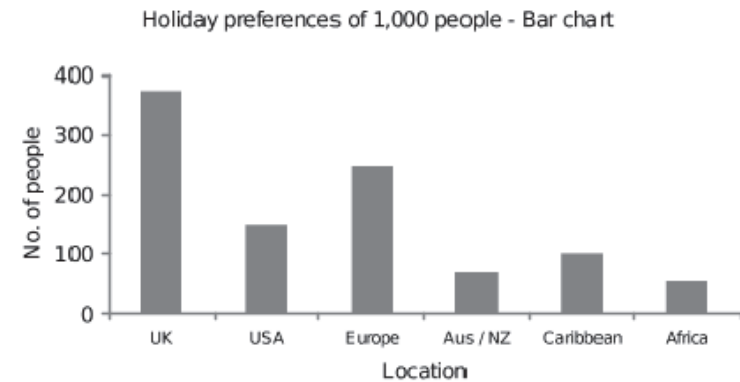
7 3 14 6 10 9 16 19 2 4 15 11 9 23 27

Mode = 9 (there are two of them
and only one of everything else)

Range = $27 - 2$
= 25

Hints

The mode can be recognised in a bar chart by the highest bar.



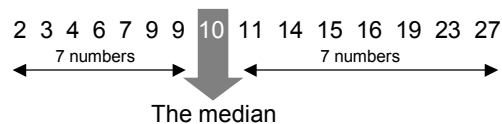
Answer to the question on the previous slide:

$$C \quad 5\sqrt{1.12 \times 1.07 \times 0.85 \times 1.22 \times 1.09} - 1 = 6.26\%$$

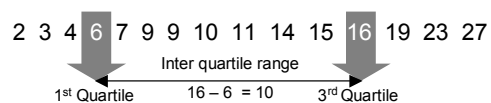
5. Summary Statistics

Median and inter-quartile range

Median



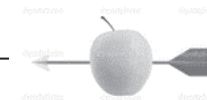
Inter-quartile range



Keeping on target

The returns on 7 funds in the City of London are 12%, 7%, 10%, 2%, 15%, 22% and 9% p.a. The inter-quartile range is closest to:

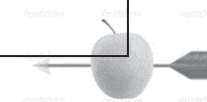
- A. 15%
- B. 10%
- C. 8%
- D. 12%



Keeping on target

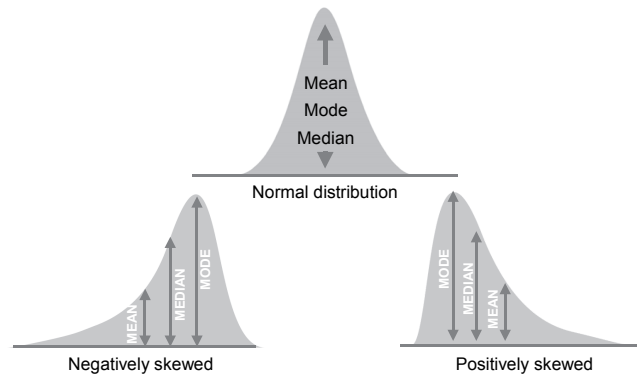
Saliy has 5 shares. Each of the shares provide the following returns 9%, 10%, 6%, 8% and 13% p.a. The 25th percentile is closest to:

- A. 6
- B. 7
- C. 8
- D. 9



5. Summary Statistics

Normal and skewed distributions



Answer to the questions on the previous slide:

C

2%, 7%, 9%, 10%, 12%, 15%, 22%

Quartile = $(7+1) / 4 = 2$ places along

$15\% - 7\% = 8\%$

B

6, 8, 9, 10, 13

Quartile = $(5+1) / 4 = 1.5$ places along

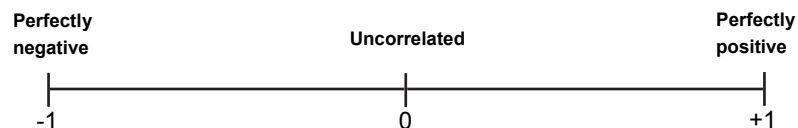
25th percentile = 1 quartile = 1.5 places along

$6 + 8 \times 0.5 = 7$

6. Correlation Coefficient

Correlation

- Combining assets which are not perfectly positively correlated allows diversification
 - Positive correlation
 - Movements in same direction
 - Negative correlation
 - Movements in opposite direction
 - Perfect correlation
 - Movements in same proportion
- Correlation coefficient



Further information

Correlation tables

	Asset A	Asset B	Asset C
Asset A	+1	-0.61	+0.34
Asset B	-0.61	+1	-0.21
Asset C	+0.34	-0.21	+1



Further information

Autocorrelation

Where a correlation coefficient is created for an asset in relation to itself. However, the returns of the asset will be compared over deferred periods, for example the monthly returns from 2011 to 2013 compared with the monthly returns from 2012 to 2014.

This correlation is then used to predict future returns.

This is often used in the property market, but can underestimate the risks associated with the asset.



6. Correlation Coefficient

Calculating correlation coefficient

$$\text{Correlation coefficient, } (\rho \text{ or } r) = \frac{\text{Cov}(x, y)}{\sigma_x \sigma_y}$$

Where:

$\text{Cov}(x, y)$ = Covariance of x and y

σ_x = Standard deviation of x

σ_y = Standard deviation of y

Keeping on target

JB and KC are restaurants open on the same street. If the variance of returns for JB is 49, the standard deviation of returns for KC is 9 and the covariance between returns is 50, The correlation coefficient is closest to:

- A. 0.11
- B. 0.49
- C. 0.79
- D. 0.86



Keeping on target

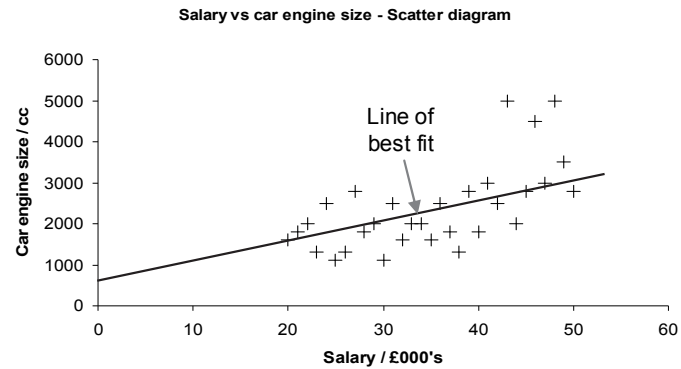
LMT runs two funds. If the standard deviation of returns for fund A is 12, the standard deviation of returns for fund B is 8 and the correlation between the two is 0.32 what is the covariance of the funds?

- A. 10
- B. 20
- C. 30
- D. 40



8. Linear Regression

Scattergrams (scatter diagrams)



Answer to the questions on the previous slide:

C

$$\frac{50}{7 \times 9} = 0.79$$

C

$$\frac{?}{12 \times 8} = 0.32$$

$$12 \times 8 \times 0.32 = 30.72$$

8. Linear Regression

Linear regression

$$y = a + bx$$

Where:

y is the dependent variable (car engine size in the example)

x is the independent variable (salary in the example)

a and b are coefficients of the equation

Forecasting using linear regression

- Extrapolation
 - Predicting an outcome outside the range of values
- Interpolation
 - Predicting an outcome not included in, but within a range of values

FitchLearning

www.fitchlearning.com

Keeping on target

JB and KC are restaurants open on the same street. Each evening 50 people go for dinner at JB and 30% of KC customers go to JB for a dessert after their meal. If KC has 130 diners on Tuesday how many customers will JB have?

- A. 50
- B. 89
- C. 100
- D. 160



Keeping on target

LMT has just set up two funds. Fund A has £140m invested and fund B has £100m invested. All investors in fund A must place a contribution equal to 38% of their fund A investment into fund B. If LMT contributed the rest of the fund B capital its contribution would be closest to:

- A. 45
- B. 46
- C. 47
- D. 48





6-10 questions

Answer to the questions on the previous slide:

B

$$50 + 0.3 \times 130 = 89$$

C

$$? + 0.38 \times 140 = 100$$

$$100 - 0.38 \times 140 = 46.8$$