

Statistics on the Casio CG-20

Task 1 – Basic statistics and charts for single variable data

The weight (in grams) of 26 blackbirds visiting a garden in a single month is shown below.

Female	Male
107	124
111	108
110	118
112	105
103	113
109	106
107	111
112	109
89	110
113	111
113	129
102	121
112	117

Source: www.mei.org.uk/data-sets

To enter a list: **MENU** **2** (STAT)

To display the 1-variable statistics: **F2** **F1** { CALC 1-VAR }

To change the list use set-up: **F2** **F6** { CALC SET }

To change to a box-plot: **F1** **F6** **▼** **F6** **F2** **EXIT** { GRAPH SET Graph-Type > MedBox }

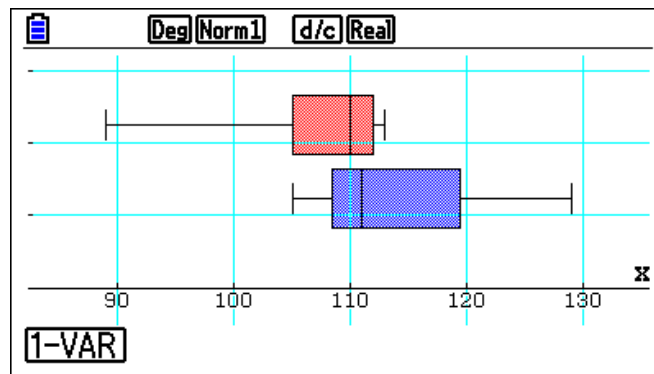
To display the graph select Graph1: **F1** (GRAPH1)

To display multiple box-plots set Graph1 and Graph 2 to MedBox and then select both.

To set Graph 2 to a box-plot:

F1 **F6** **F2** **▼** **F6** **F2** **EXIT** { GRAPH SET GRAPH2 Graph-Type > MedBox }

To draw Graph 1 and Graph 2: **F4** **▼** **F1** **F6** {SELECT StatGraph2:DrawOn DRAW}



Question

What can you say about the weight of female and male blackbirds based on the charts and statistics?

Further task

Find some other 1-variable datasets to compare.

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Task 2 – Mean and standard deviation of grouped data

The weight (in grams) of blackbirds visiting a garden is shown below.

Compare the weights of the birds observed in the summer and winter months.

	Mar-Aug	Sep-Feb
Weight (g)	Frequency	Frequency
70-79	1	0
80-89	6	0
90-99	22	14
100-104	12	23
105-109	4	24
110-114	1	19
115-119	1	15
120-129	1	6
130-139	0	1

Source: www.mei.org.uk/data-sets

To enter a list: **MENU** **2** (STAT)

To change the list use set-up: **F2** **F6** { CALC SET }

To use a list as a frequency select set-up: **F2** **F6** { CALC SET }

To display the 1-variable statistics: **F2** **F1** { CALC 1-VAR }

Question

What can you say about the weight of birds observed in the summer and winter months?

Further task

Find some other grouped datasets to compare.

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Task 3 – Discrete random variables

You have devised a game where a coin is tossed 3 times and the players received the following prizes based on the number of heads obtained:

	Prize	Probability
3 heads	£5	0.125
2 heads	£2	0.375
1 head	£1	0.375
0 heads	£0	0.125

To enter a probability distribution use the probabilities as frequencies.

To enter a list: **MENU** **2** (STAT)

To change the list use set-up: **F2** **F6** { CALC SET }

To use a list as a frequency select set-up: **F2** **F6** { CALC SET }

To display the 1-variable statistics: **F2** **F1** { CALC 1-VAR }

Question

What is the expected winnings and how much should you charge per player so that you make a profit?

Could you change the prizes so that the game was more attractive but you would still expect to make a profit.

Further task

Find some other discrete random variables to investigate.

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Task 4 – Bivariate data

The weight in grams and wing length in millimetres of 13 male blackbirds visiting a garden in a single month is shown below.

Weight (g)	Wing length (mm)
124	139
108	129
118	129
105	125
113	134
106	133
111	130
109	130
110	125
111	132
129	144
121	132
117	137

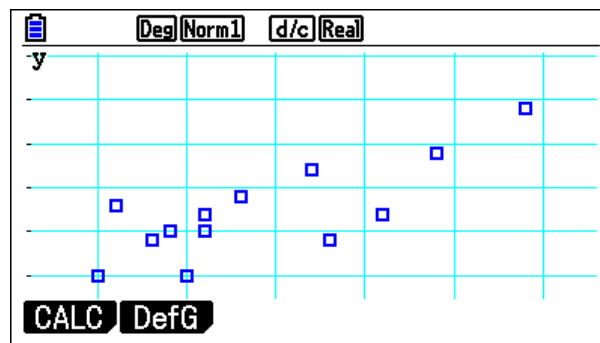
Source: www.mei.org.uk/data-sets

To display the regression and correlation statistics in statistics mode:

F2 **F3** **F1** **F1** { CALC REG X ax+b }

The PMCC is the value of r .

To plot the scatter graph check that the graph is set to
Graph Type: Scatter, Xlist: List 1, YList: List2



Question

Is there a correlation between weight and wing length?

NB The critical value of PMCC for $n = 13$ at the 5% level is 0.476.

Further task

Find some other bi-variate datasets to investigate.

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Task 5 – The Binomial Distribution

A six-sided die is rolled twelve times and the number of sixes rolled is counted. This number of sixes can be modelled as a binomial distribution: $X \sim B\left(12, \frac{1}{6}\right)$

- What is the probability of rolling exactly two sixes?
- What is the probability of rolling more than two sixes?

All calculations are in Stats Mode: **MENU** **2**

Calculating the probability of a single value

Find $P(X = x)$ using Bpd: **F5** **F5** **F1** { DIST BINOMIAL Bpd }

Set List:Var, x:2, Numtrial:12, p=1/6: **F2** **▼** **2** **EXE** **1** **2** **EXE** **1** **÷** **6** **EXE**

Press Execute to calculate: **EXE**

```
Binomial P.D
Data :Variable
x :2
Numtrial:12
p :0.16666666
Save Res:None
Execute
[None] LIST
```

```
Binomial P.D
p=0.29609356
```

Calculating the probability of a range of values

Find $P(x_1 \leq X \leq x_2)$ using Bcd: **F5** **F5** **F2** { DIST BINOMIAL Bcd }

Set List:Var, Lower:3, Upper:12 Numtrial:12, p=1/6:

F2 **▼** **3** **EXE** **1** **2** **EXE** **1** **2** **EXE** **1** **÷** **6** **EXE**

Press Execute to calculate: **EXE**

```
Binomial C.D
Data :Variable
Lower :3
Upper :12
Numtrial:12
p :0.16666666
Save Res:None
[None] LIST
```

```
Binomial C.D
p=0.3225738
```

Tasks

- A coin is tossed 10 times. How many times would it need to land on heads (or tails) to make you suspicious that the coin was biased?
- A multiple choice test has n questions, 4 options for each question and a pass mark of 50%. Investigate the chance of passing for values of n .
- Find (or make up!) a situation that can be modelled by a Binomial distribution and investigate it.

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Task 6 – The Normal Distribution

Assuming the heights of adult males in the UK are Normally distributed with mean 175cm and standard deviation 9cm.:

- What proportion of the population would you expect to be between 1.7m and 1.8m?
- What proportion of the population would you expect to be over 1.885m?
- What height would you recommend door frames be made at?

Calculating probabilities directly

Find $P(x_1 < X < x_2)$ using:

MENU **1** **OPTN** **F5** **F3** **F1** **F2** { MENU RUN Option > STAT > DIST > NORM > Ncd }
Syntax is **NormCD(lower bound, upper bound, σ , μ)**

Calculating probabilities from z-values

Calculate the standardised z-value: $z = \frac{x - \mu}{\sigma}$

Find $P(Z < z)$ using:

MENU **1** **OPTN** **F6** **F3** **F6** **F1** { MENU RUN Option > Prob > P() }

Inverse Normal Distribution calculations

Find X such that $P(x < X) = p$ using:

MENU **1** **OPTN** **F5** **F3** **F1** **F3** { MENU RUN Option > STAT > DIST > NORM InvN }

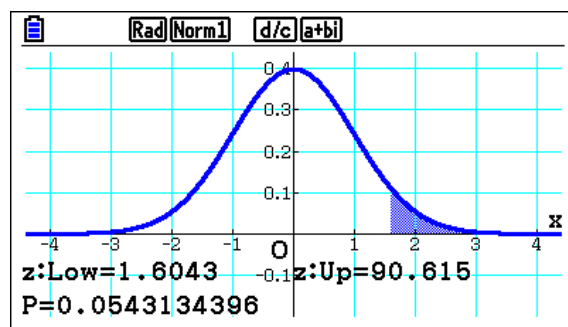
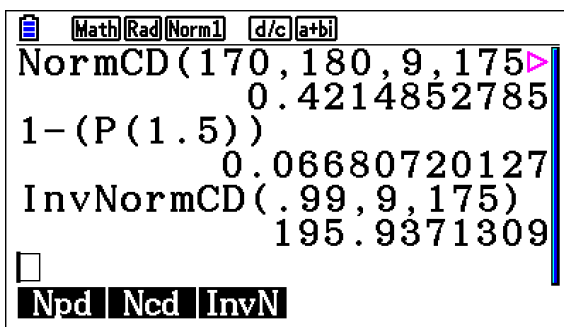
Syntax is **InvNormCD(probability, σ , μ)**

Calculating probabilities by plotting the curves

To plot the curve use: **MENU** **2** **F5** **F1** **F2** { MENU STAT DIST NORM Ncd }

Set Data to "Variable", and set the mean, standard deviation and limits. Scroll down and select **F6** { DRAW }

For a 1-tail probability use an extreme value (e.g. Lower: -1000)



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Task 7 – The Poisson Distribution

Customers enter a shop at an average of three per minute. The number of customers entering the shop in a given minute can be modelled by a Poisson distribution: $X \sim P(3)$

- What is the probability of exactly one customer entering the shop in a minute?
- What is the probability of five or fewer customers entering the shop in a minute?

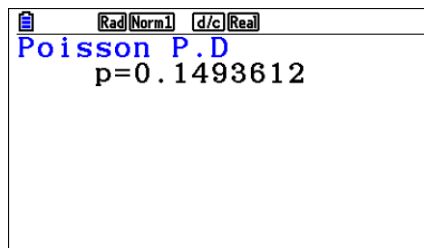
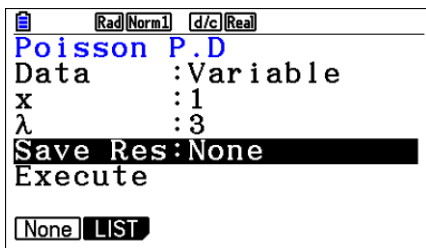
All calculations are in Stats Mode: **MENU** **2**

Calculating the probability of a single value

Find $P(X = x)$ using Ppd: **F5** **F6** **F1** **F1** { DIST > POISSON Ppd }

Set List:Var, x:1,λ:3: **F2** **▼** **1** **EXE** **3** **EXE**

Press Execute to calculate: **EXE**

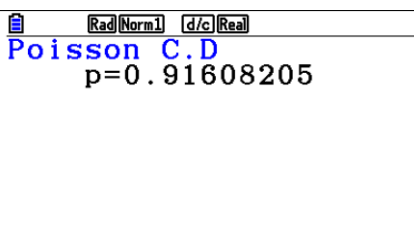
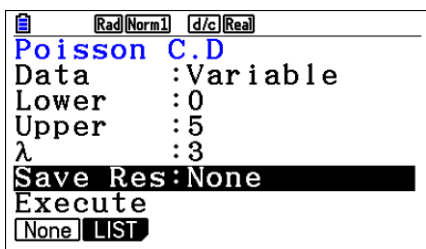


Calculating the probability of a range of values

Find $P(x_1 \leq X \leq x_2)$ using Pcd: **F5** **F6** **F1** **F2** { DIST > POISSON Pcd }

Set List:Var, Lower:0, Upper:5, λ:3: **F2** **▼** **0** **EXE** **5** **EXE** **3** **EXE**

Press Execute to calculate: **EXE**



Tasks

- On average 17 passengers arrive at a station every minute. Electronic gates let passengers through every 20 seconds. Investigate the number of gates required and the likelihood of queues forming.
- On average how many text messages/emails/phone calls do you receive in a day? Investigate whether they can be modelled by a Poisson distribution.
- Find (or make up!) a situation that can be modelled by a Poisson distribution and investigate it.

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Importing Data onto the CG20

NB Data files should be saved as .csv without column headers

0. *This step is only necessary the first time you import data:*

Select Memory (Option F) from the main menu:

MENU **ALPHA** **tan**

Select Storage Memory and make a folder called DATA
FOLDER > MKEFLDR

F2 **F4** **F1**

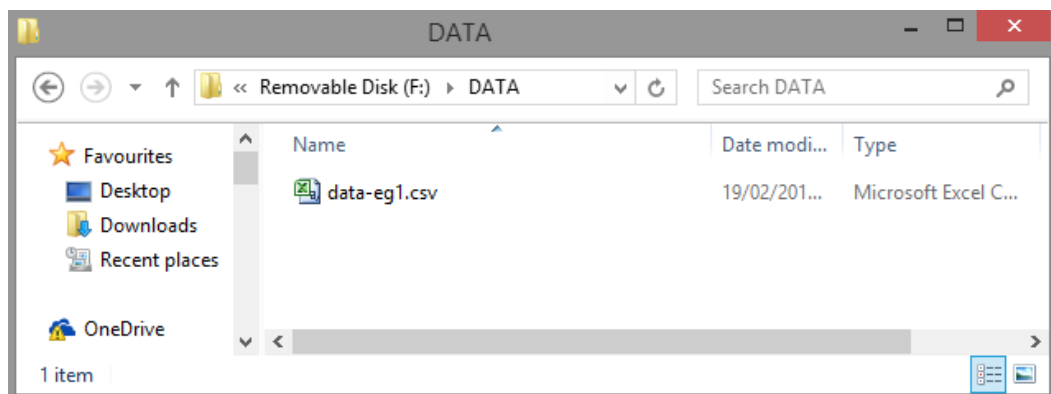
1. Select Link (Option E) from the main menu: **MENU** **ALPHA** **cos**

2. Connect the Calculator to the computer with a USB cable.

Select Connection Mode: USB Flash: **F1**

The calculator should appear as a drive (similar to a USB stick).

3. Copy your .csv file into the DATA folder on the calculator.



4. Eject the calculator drive on your computer.

5. Select Memory (Option F) from the main menu to check that the data has imported into the Storage memory: **MENU** **ALPHA** **tan** **F2**

6. To import the data into a list in Statistics mode select CSV > LOAD > FILE:

MENU **2** **F6** **F6** **F1** **F1** **F2**

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Statistics Tasks: Teacher guidance

The statistics tasks are designed to give students information about how to use the calculators for different methods. All the sheets feature some data for the students to use whilst learning how to use different functions.

Students should then be encouraged to try using the calculators with some standard questions and some data of their own. You should have questions on the topic prepared for them to try using the calculators with.

You should ensure that you are comfortable with how to set-up the settings for Var1 and Var2 for both the statistics and graphs.

Task 1 - Basic statistics and charts for single variable data

When one or more boxplots are displayed F1 (1-VAR) will give the 1-Variable statistics. With two boxplots you can use the cursor to select which dataset to display the statistics for.

Task 2 – Mean and standard deviation of grouped data

To enter grouped data students should use the mid-point of the interval. Means and standard deviations can be calculated as in task 1.

Task 3 – Discrete random variables

Discrete random variables can be entered using probabilities for frequencies. The statistics can be calculated using 1-VAR with 1Var XList: List 1 and 1Var Freq: List 2. Ensuring that the sum of the frequencies: $n = 1$ is a useful check.

The expected value of this random variable is £1.75.

Task 4 – Bivariate data

Be prepared to highlight the important points or be able to steer the discussion towards them, e.g. elliptical shape of sample data.

The variety of regression models available (e.g. x^2 , x^3) is a good opportunity to highlight to students the importance of linear regression.

The critical value of PMCC for $n = 13$ at the 5% level is 0.476. This data has a PMCC value of 0.7817 which is significant at the 5% level.

Task 5 – The Binomial Distribution

The Binomial PD (Probability Distribution) function calculates the probability of a specific result being obtained from a Binomial Distribution: i.e. $P(X = x_1)$.

The Binomial CD (Continuous Distribution) function calculates the probability of a value from

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a range being obtained from a Binomial Distribution: i.e. $P(x_1 \leq X \leq x_2)$.

Students should be encouraged to consider how they would enter ranges in other formats, e.g. $P(X < x_1)$, $P(X > x_1)$, $P(X \leq x_1)$, ...

Task 6 – The Normal Distribution

Screenshots for the numerical and graphical methods for the calculations are shown on the sheet. Students should be encouraged to explore both.

Task 7 – The Poisson Distribution

The Poisson PD (Probability Distribution) function calculates the probability of a specific result being obtained from a Poisson Distribution: i.e. $P(X = x_1)$.

The Poisson CD (Continuous Distribution) function calculates the probability of a value from a range being obtained from a Poisson Distribution: i.e. $P(x_1 \leq X \leq x_2)$.