

# S5 • Interpreting bar charts, pie charts, box and whisker plots

## Mathematical goals

To help learners to:

- understand and interpret bar charts, pie charts, and box and whisker plots.

## Starting points

This session is in two linked parts.

- Matching pie charts to bar charts.
- Matching box and whisker plots to bar charts.

Each part of the session starts with a whole group discussion to compare the newly-introduced type of representation, looking at its advantages, disadvantages and practical applications. Learners then work in pairs.

No prior knowledge is assumed, though it is helpful if learners have encountered some of these ideas before.

If computers are available, solutions may be checked using the computer program *Statistics 2* that is provided on the DVD-ROM/CD.

## Materials required

An overhead projector or data projector is very helpful during the introduction.

For each small group of learners you will need:

- Card set A – *Bar charts*;
- Card set B – *Pie charts*;
- Card set C – *Box and whisker plots*;
- Card set D – *Making your own cards*;
- OHT 1 – *Statistical representations* (optional);
- The computer program *Statistics 2* (optional).

## Time needed

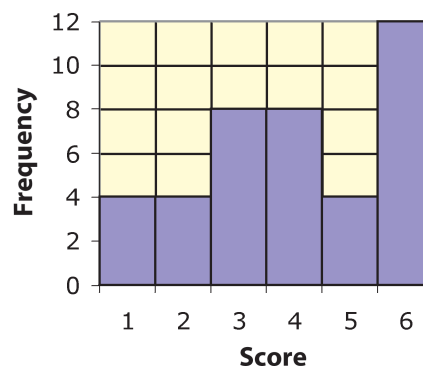
Approximately 2 hours.

The session is in two linked parts. Each part will take up to 1 hour.

## Suggested approach **Beginning the session**

Introduce the session using OHT 1 – *Statistical representations*, or using the computer program *Statistics 2* and a data projector. Start by drawing on the board the bar chart shown here. If a data projector is used, display the bar chart using the program *Statistics 2* and hide everything except the bar chart.

This bar chart represents the scores that were obtained when a number of people entered a penalty-taking competition. Each person was allowed six penalty kicks.



How many people entered the competition?

How can you tell?

How can you calculate the mean, median and modal number of penalties scored?

What proportion of the people scored one penalty?

What is that as a percentage?

What proportion scored three penalties? Six penalties?

Can you think of another type of statistical diagram that can be used to show proportions?

You can use this to introduce the idea of a pie chart. Ask learners to sketch one if they can, then show them how this can be done. Focus attention on the pie chart through careful questioning. For example:

Does the pie chart tell you how many people entered the competition?

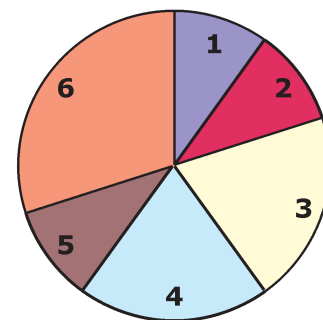
No? So what does it tell you?

How can you find the mode and median from the pie chart?

Can you estimate the percentage that scored six goals?

If only four people had scored six goals, what would the pie chart have looked like?

If I halve/double the heights of all the bars in the bar chart, what will happen to the pie chart?



Try to draw out from learners the relative advantages and different uses of bar charts and pie charts, e.g. bar charts help you to see the shape of the distribution and give you more data, including the numbers involved. Pie charts help you to see the proportions (or fractions) of the total in each category.

### Working in groups (1)

Hand out Card set A – *Bar charts* and Card set B – *Pie charts* to each pair of learners. Ask learners to match the cards from each set.

As they work on this task, encourage learners to explain how they know that particular cards match. When learners are stuck, ask questions that might help them to develop a strategy.

Which bar charts have the smallest range?

How is the range shown on the pie chart?

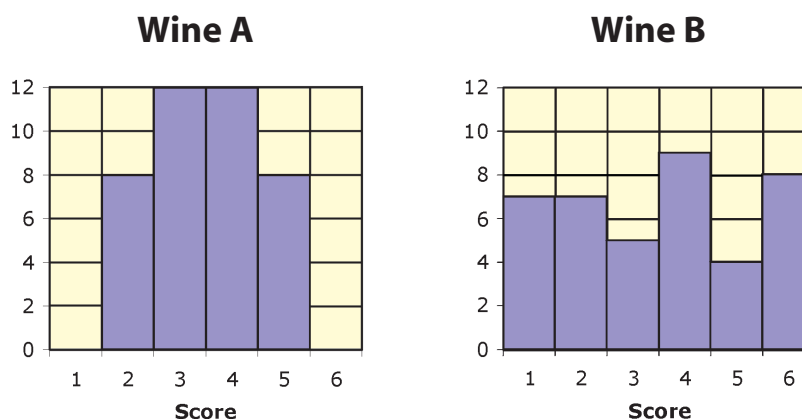
What is the modal score on the bar chart?

Which pie charts have the same mode?

If some learners complete the matching task quickly, give them copies of Card set D – *Making your own cards* and ask them to devise two matching card sets of their own.

### Whole group discussion

Draw the two bar charts shown here on the board.



Forty people are asked to taste two types of wine. Each is asked to rate the wine on a scale from 1 to 6. 1 = awful, 6 = fantastic. The graphs show the results of the wine tasting. What can you say about the wines? If you had someone coming to dinner, which wine would you choose? Why?

Both wines have the same mean score, 3.5. People share a similar view about wine A, but they have a wide spread of views about wine B. There is a statistical diagram that is helpful when making comparisons of spread: the 'box and whisker' plot.



Explain the five data points that are used to construct the box and whisker plot:

- the least and greatest values (the whiskers);
- the median (the middle line);
- the quartiles (the ends of the boxes).

Explain that box and whisker plots can be drawn vertically or horizontally.

For wine A, the range is from 2 to 5, the median is 3.5 (20 scores are above and 20 are below this value) and the quartiles are at 3 and 4 (when the 40 scores are placed in order, the 10th score is 3 and the 30th is 4).

For wine B, the range is from 1 to 6, the median is 4, and the quartiles are at 2 and 5.

### Working in groups (2)

Hand out Card set A – *Bar charts* and Card set C – *Box and whisker plots* to each pair of learners.

Ask learners to work together to match the cards from each set. They should try to do this without doing calculations.

As learners work on this task, encourage them to take turns at explaining how they know particular cards match. When learners are stuck, ask questions that might help them to look at the overall structure.

Can you sort the cards into those that have a large range and those that have a small range?

Can you sort the cards into those that have a large median and a small median?

Does the distribution look spread out (the 'box' is large), or is it concentrated in a few scores (the 'box' is small)?

Does the distribution look symmetrical, or is it skewed?

## Reviewing and extending learning

Show OHT 1 – *Statistical representations* (or use the *Statistics 2* software provided) and ask learners questions to review the session.

For example:

- Show a frequency table and ask learners to predict what the bar chart, pie chart and/or the box and whisker plot will look like.
- Show just a pie chart and ask for a suitable bar chart.
- Show just a box and whisker plot and ask for a suitable bar chart.

... and so on.

In each case approximate answers, with reasons, will be sufficient.

**S6 Interpreting frequency graphs, cumulative frequency graphs, box and whisker plots** is a good follow-up to this session.

## What learners might do next

## Further ideas

This activity uses multiple representations to deepen understanding of statistical measures. This type of activity can be used in any topic where a range of representations is used. Examples in this pack include:

**N5 Understanding the laws of arithmetic;**

**A1 Interpreting algebraic expressions;**

**SS6 Representing 3D shapes.**

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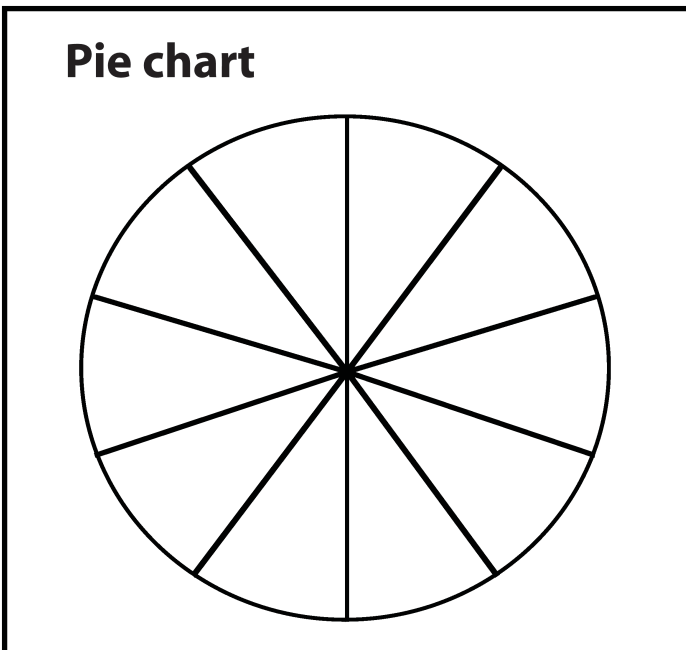
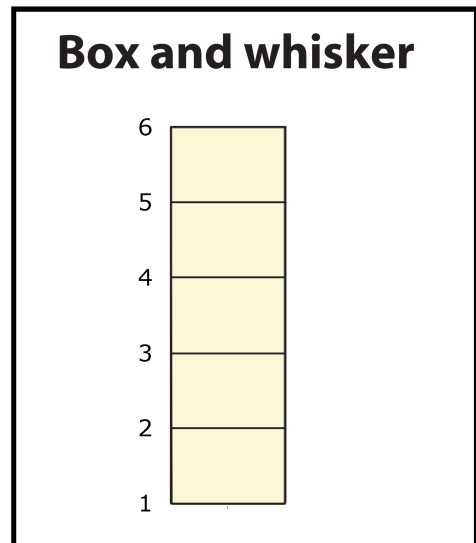
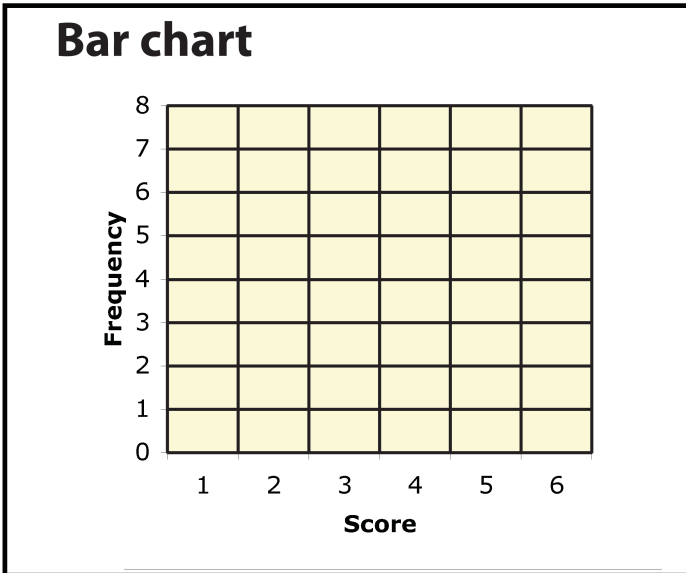
S5 OHT 1 – Statistical representations

### Frequency table

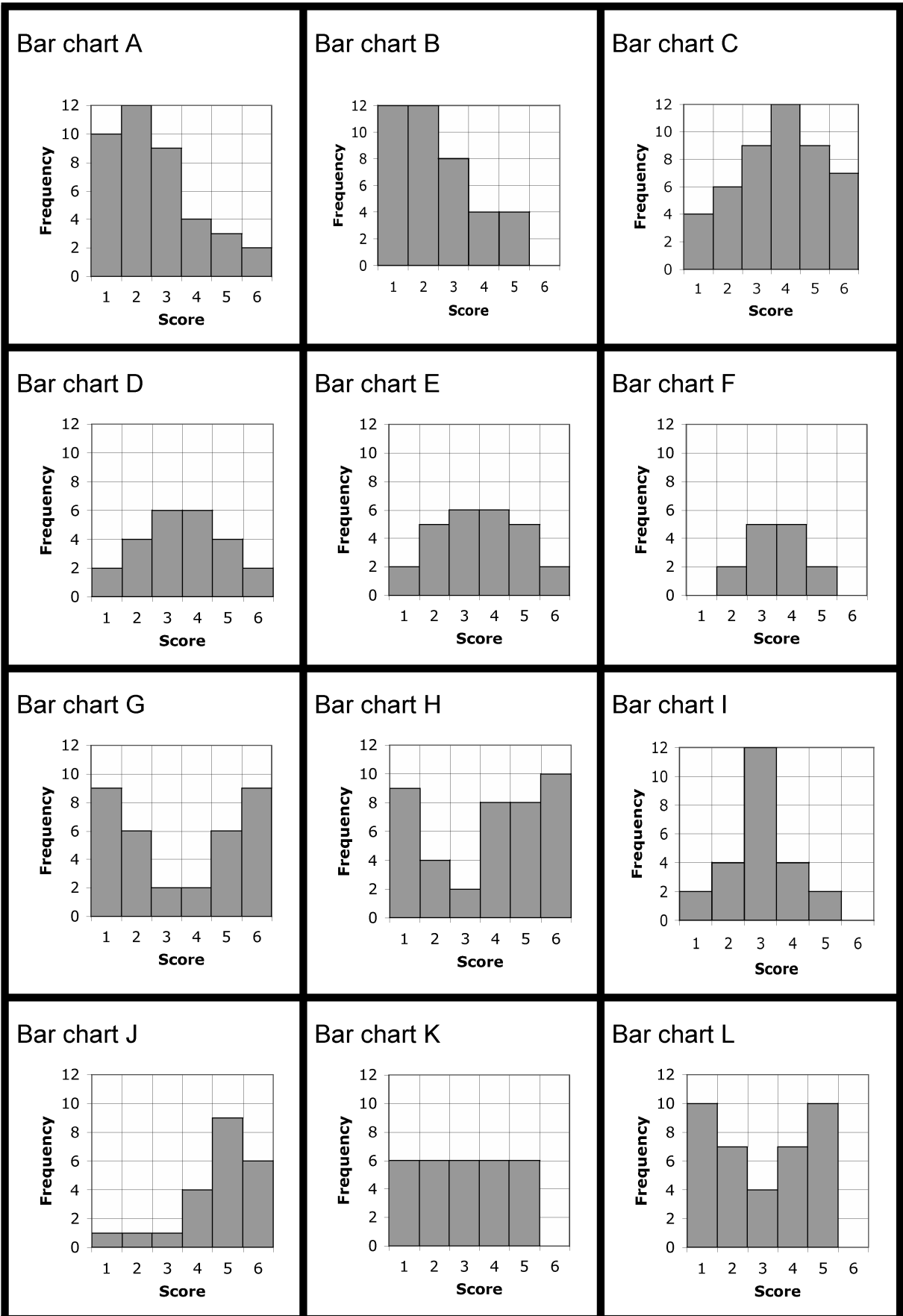
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### Statistics

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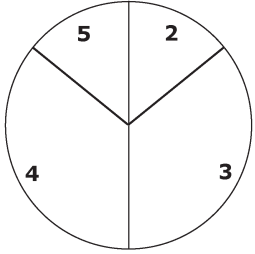
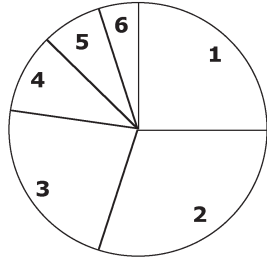
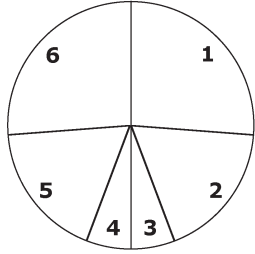
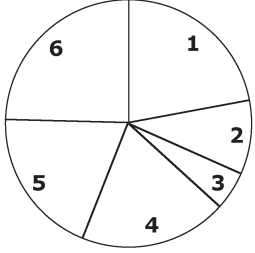
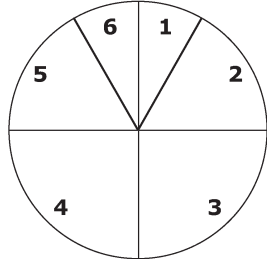
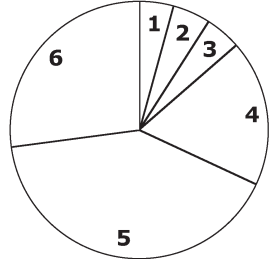
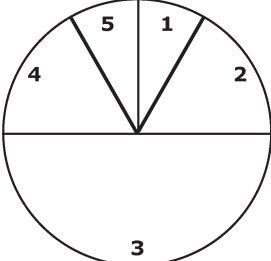
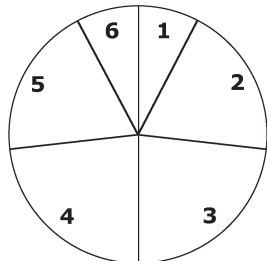
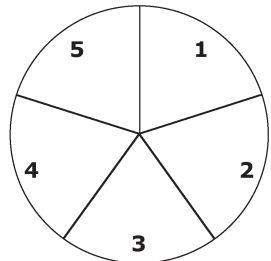
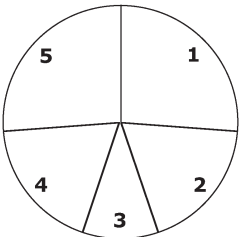
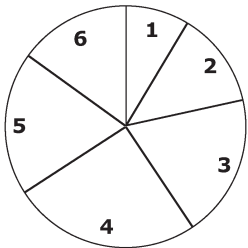
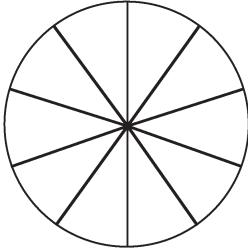


**S5 Card set A – Bar charts**

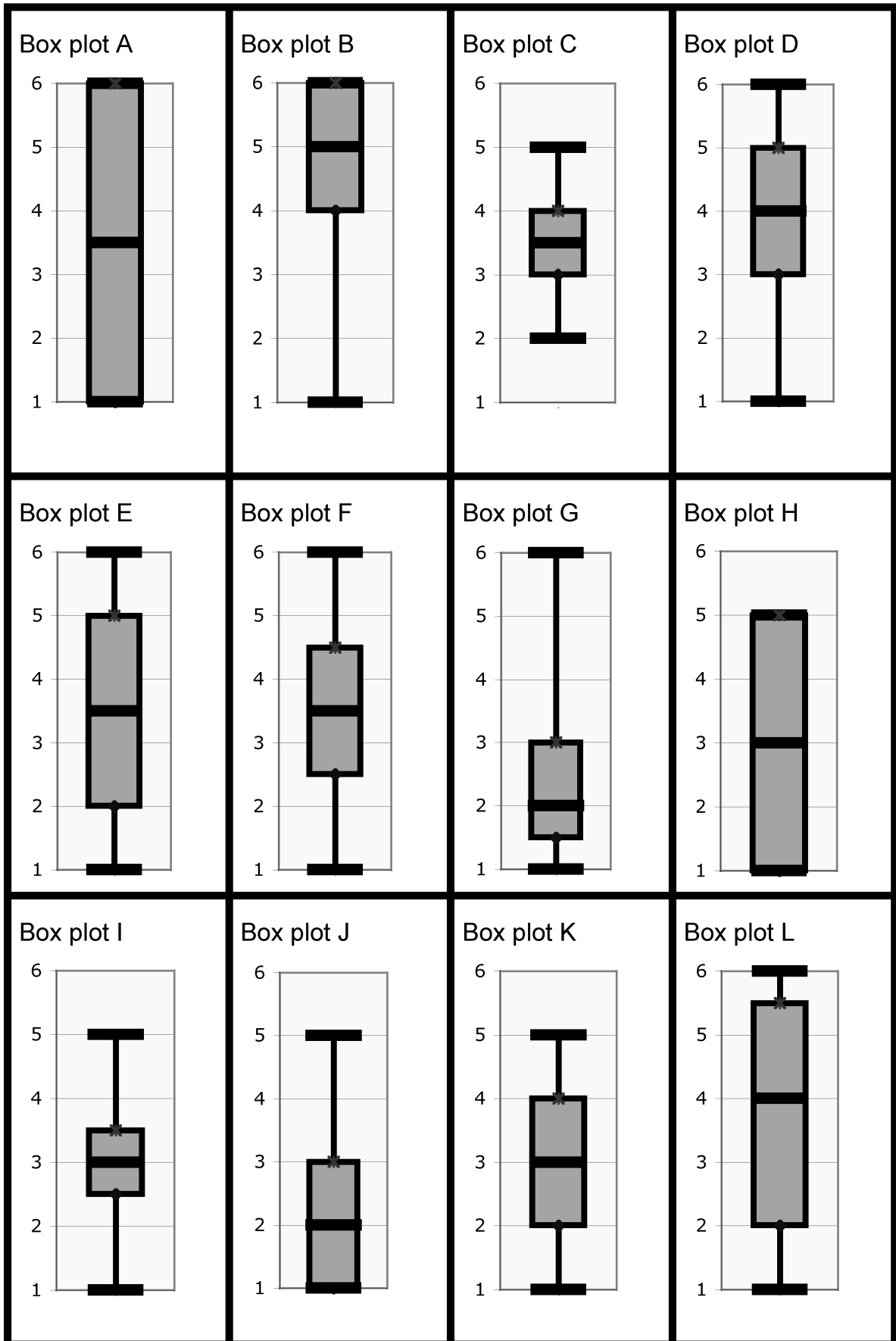




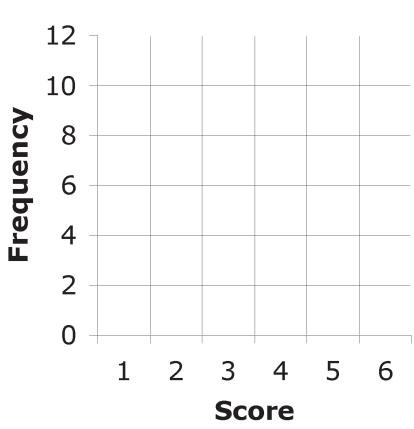
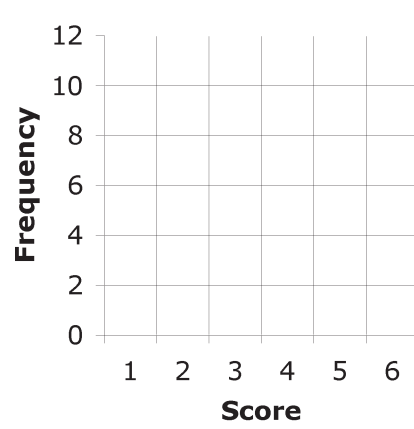
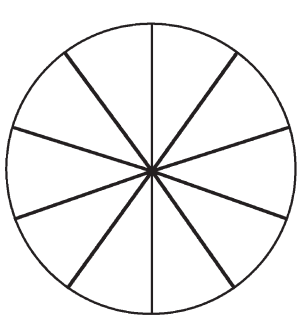
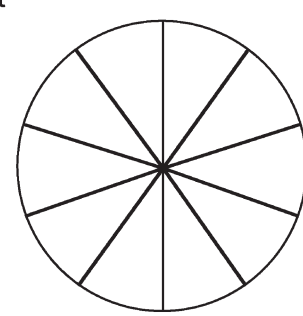
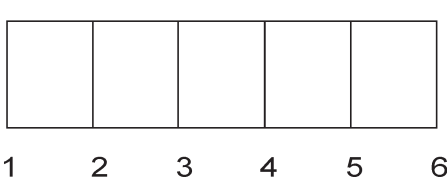
**S5 Card set B – Pie charts**

<p>Pie chart A</p> 	<p>Pie chart B</p> 	<p>Pie chart C</p> 
<p>Pie chart D</p> 	<p>Pie chart E</p> 	<p>Pie chart F</p> 
<p>Pie chart G</p> 	<p>Pie chart H</p> 	<p>Pie chart I</p> 
<p>Pie chart J</p> 	<p>Pie chart K</p> 	<p>Pie chart L (complete this yourself)</p> 

S5 Card set C – Box and whisker plots



**S5 Card set D – Making your own cards**

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