# Spreadsheet Modelling

## Definition of a simulation model.

## Advantages and disadvantages of using simulation models.

### Describe what is meant by simulation modelling and give two advantages and one disadvantage of using simulation models. [4]

Simulation modelling means using a computer and mathematical formulas to imitate a real life situation.

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| Advantages | Disadvantages |
| Enables predictions to be made in areas which may be dangerous to humans. It is usually much cheaper as do not have to crash planes or cars. Some situations cannot be performed in real life for testing purposes - a 10% price hike, making a nuclear reactor go critical. Easier to study long term affects by speeding up time scale or by slowing down.  | Prediction only as accurate as the rules or data entered. Powerful expensive computer hardware needed to run the simulations. Some things, such as earthquakes, are hard to predict accurately and so hard to simulate. |

### A large stationery company would like to use computer software to give customers quotations for their stationery needs and to work out commission for their sales staff. Describe the benefits of using spreadsheet software for these tasks. [4]

* Ability to recalculate the quote – if a customer adds or takes away items from the list, can automatically recalculate the cost.
* Can perform ‘what if’ models the cost of different qualities, items, etc.
* Can show graphically by producing various charts and graphs of sales.
* Show comparison between different salesmen to foster competition.
* Accurate calculation of commission – will increase efficiency and saves time by preventing sales staff from having query errors.

### A building company uses a spreadsheet to calculate staff wages and also to give quotes for building projects to customers. Describe the benefits the company gets from using spreadsheet software for these two purposes. [4]

* Automatic recalculation - if data such as rate of pay changes
* Can do what if calculations - on staffing or different materials/suppliers
* Can draw graphs for reports - to highlight wages of different departments/compare monthly wage bill
* Accurate calculation of wages/quotes - will increase efficiency/save time
* Setting up templates - to work quotes out more quickly

### A design company uses spreadsheet software for financial modelling. Give two advantages to the company of using spreadsheets for financial modelling and illustrate each with a specific use. [2×2]

* Automatic recalculation if data such as rate of pay changes
* Can do what if calculations on staffing or use of different materials/designs
* Can draw graphs for reports to highlight wages of different departments / compare monthly wage bill
* Accurate calculation of wages/quotes will increase efficiency/save time
* Setting up templates to work quotes out more quickly

Uses of simulation modelling for weather forecasting, car crash analysis and financial forecasting.

### Weather forecasting is one area which now uses simulation modelling. Describe, in general, how the models are created and the advantage and disadvantage of modelling in this context. [4]

* Produce a set of equations (mathematical model) which are solved to predict weather twice a day
* Collect data, compare actual with observed, create model, test the model.
* Large number of measurements such as pressure, temperature, humidity.
* Information comes from all over the world, sources such as radar, satellites, balloons, etc.

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| Advantages | Disadvantages  |
| Only takes 1 hour to produce a 6 day forecast. Can predict path of hurricanes, etc. Can help farmers plan work.  | 160 million equations solved – cost of buying a supercomputer. Long range forecasts cannot be 100% accurate in predictions. |

### Simulation modelling is very important in weather forecasting. Describe how the models are created and give one advantage and one disadvantage that simulation modelling has brought to weather forecasting. [4]

Large number of measurements such as pressure, temperature, humidity, etc.

Readings from all around the world from satellites, balloons, etc.

Models provide a set of equations to solve / Produce a set of equations (mathematical model) which are solved to predict weather twice a day.

Test / compare

Actual with observed.

Create model / test the model.

What ifs.

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| Advantages | Disadvantages |
| Only takes 1 hour to produce a 6 day forecast.Can predict path of hurricanes, etc. Can help farmers plan work / Local councils plan / etc. | 160 million equations to solve – cost of buying a supercomputer. Long range forecasts cannot be 100% accurate in predictions. Freak storm / unusual patterns difficult to predict. |

### Describe the advantages and disadvantages of using simulation modelling in car crash analysis. [3]

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| Advantages | Disadvantages |
| Cheaper as do not have to physically destroy cars. Safer as nobody is really hurtMuch more flexible Can explore different scenarios more easily  | Model could oversimplify the situation and not be accurate enough Bad data errors in formulas will spoil accuracyNo model is ever 100% accurate |

### Describe a specific use of simulation modelling in financial forecasting and give two advantages for this use. [3]

* Allows the government to predict what will happen if they changed some factors such as raising taxes, reducing interest rates, changing amount of public spending
* What will be the savings to the Government if they make half the number of civil servants redundant?
* What will be the income to the government if they put a 1% fuel tax rise on petrol?
* How much will the extra payroll cost be if a company gives its workers a 3% rise in salary?
* Can see the effect of different situations on the stock market

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| Advantages |
| Possible to experience a lot more situations Cheaper as not going to waste money on impossible actionsIt can save time as you can roll on the model to see what it is like after more than one yearIt can give a government time to prepare for a financial crisis |

### b) Describe a specific use of simulation modelling for financial forecasting, and give one advantage and one disadvantage for this use. [3]

Allows the government to predict what will happen if they changed some factors such as raising taxes, reducing interest rates, changing amount of public spending.

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| Advantages | Disadvantages |
| Possible to experience a lot more situations Cheaper as not going to waste money on impossible actions It can save time as you can roll on the model to see what it is like after more than one year | There will always be some difference between simulation and realityAccuracy of the rules and variables Some situations are hard to model. |