# Worksheet 5 Abstraction and automation Answers

**Task 1**

1. An algorithm is to be written to find the shortest route between two points. How can abstraction be applied to this problem?

“Information hiding” can be applied to hide all the details which are not relevant to the problem, for example in a wide-area network whether a network cable goes under the sea, whether it is copper or fibre-optic. In a road system, roadworks, the size of the towns passed through etc. are irrelevant to the question of distance.

What applications could such a program be useful for?

Routing a packet on a network, navigating between two towns using a sat-nav, planning a route for parcel deliveries.

2. Give examples of some problems which can be “solved” by computer simulations

Predictions of global warming, population increases, number of doctors and teachers required in 10 years’ time, prediction of likely consequences of an earthquake, financial modelling to predict future profits/losses.

3. What factors would be relevant in a financial model which calculates the likely annual profit in a new coffee shop?

Some suggestions:

The store rental, opening hours, number of people passing the shop on weekdays/weekends, number of other coffee shops in the area, whether it is an affluent area, number of people that can be served in a one-hour period

Price of coffee, milk, sugar, price that it would be reasonable to charge, number of staff required, cost of wages, set-up costs

What factors would be irrelevant?

Arguably, the floor area of the shop, where the shop is situated, the length of the shop lease, the colour scheme used, average age of population in the area. Could also suggest: the name of the manager, the gender/age of the staff in the shop, the size of the cups, efficiency of the dishwasher, etc.

**Task 2**

4. You have been asked to write a procedure to count the number of vowels in a sentence. How can you ensure that the procedure will work for any length of sentence?

By putting the characters of the sentence into an array, passing the array as a parameter to the subroutine and returning the number of vowels.

5. To implement a stack, you would need three procedures: InitialiseStack(stack, pointer), AddToStack(stack, pointer, item), RemoveFromStack(stack, pointer, item).

The identifiers in brackets are **parameters** defined in the main program and passed to the procedure.

What procedures and parameters would you need to be able to implement a queue?

Students will not have studied queues at this point but can probably work out that items are removed from the front of a queue and added to the rear. There may be a maximum size to the queue. They should be able to come up with something similar to:

InitialiseQueue(queue, maxNumberInQueue, numberInQueue) (set up empty queue with numberInQueue = 0 and front and rear pointers set to 0.)

AddToQueue (queue, rear, maxNumberInQueue) (can’t add to a full queue)

RemoveFromQueue(queue, front, numberInQueue) (can’t remove an item from an empty queue)

6. A car dealer might use a procedure for displaying different models of a particular make of car. The user can specify what model they are interested in, how many doors the car should have, the paint colour, wheels, and interior specifications.

Draw a hierarchy chart to show how the procedure for displaying a particular model might be broken down into separate tasks and subtasks.

What type of abstraction is being used in this problem?

Information hiding, procedural abstraction, composition/decomposition

Options

Paint options

Wheel options

Get Paint choice and display

Get wheel choice & display

Get interior choice & display

Interior options

Car Options

Display interface and get model

7. Solve the puzzle.

What is the answer to Roll #6?

4

Why?

**If students get stuck and need a little clue, you can tell them that the name of the game is ‘Petals around the rose’. This name is significant.**

The “rose” is the single dot in the middle in throws of 1, 3 and 5. In the first throw, only the throw of five has dots surrounding the rose in the middle. The “petals” are the dots surrounding the one in the centre.

The lesson here is to take into account all the information given! It is also an exercise in applying abstraction (information hiding), in that the numbers signified by the dots are irrelevant here – if the problem was not given in the context of dice, the solution might be more obvious.

There are other problems which use a similar principle. An example is to be able to produce a correct sentence, having heard 3 or 4 examples:

“I like cabbage but I don’t like beans”

“I like cheddar but I don’t like Stilton”

“I like butterflies but I don’t like moths”

The answer is that if the word contains a double letter, it’s in the “I like” category. Again, the actual words are irrelevant and the problem would be easier to solve with random letters.