

1(a). The map shown below in Fig.1 is of a city and surrounding districts. The map is an *abstraction* made up of a number of component parts.



Fig.1

Using the map in Fig.1 as an example, define the term *abstraction*.

[4]

(b). Both map making and program development make use of reusable components.

(i) Give **three** examples of how reusable component parts are used in Fig.1.

1

2

3

[3]

(ii) Explain how programmers make use of reusable components when developing large programs.

[3]

2(a). DriveSim Tutor is a 3D driving simulator program designed to allow learner drivers to practice following the Highway Code whilst driving through a virtual town.

The simulator's developers study a real town. They then use abstraction on their findings before designing a virtual town.

Explain why it is necessary for the developers to use abstraction.

[2]

(b). As a result of abstraction there will be similarities and differences between the virtual and real town.

(i) State **two** similarities there might be between the virtual and real town. Explain why these similarities exist.

1

2

[4]

(ii) State **two** differences between the virtual and real town.

1

2

[2]

3. A car racing team uses a car simulator to test their drivers in a range of cars on different race tracks.

The car simulator uses an abstraction of the real car and race track. Identify **two** ways in which the simulator could use abstraction.

1

2

[2]

5. A software developer is creating a Virtual Pet game.

The user can choose the type of animal they would like as their pet, give it a name and then they are responsible for caring for that animal. The user will need to feed, play with, and educate their pet.

The aim is to keep the animal alive and happy, for example if the animal is not fed over a set period of time then the pet will die.

- The game tells the user how hungry or bored the animal is as a percentage (%) and the animal's intelligence is ranked as a number between 0 and 150 (inclusive).
- Hunger and boredom increase by 1% with every tick of a timer.
- When the feed option is selected, hunger is reduced to 0.
- When the play option is selected, bored is reduced to 0.
- When the read option is selected, the intelligence is increased by 0.6% of its current value.

An example of the game is shown:

```
What type of pet would you like? Fox or Elephant?  
Fox  
What would you like to name your Fox?  
Joanne  
Joanne's stats are  
Hunger: 56%  
Bored: 85%  
Intelligence: 20  
What would you like to do with your pet? Play, Read or Feed?
```

Fig. 1.1



The developer made use of abstraction when creating the Virtual Pet game.

Discuss the need for and purpose of abstraction and how abstraction will be used in the development of the game.

[9]

A series of 20 horizontal dashed lines spanning the width of the page, providing a template for writing or drawing.

6.

A country's national rail operator wants to represent their rail network on a computer system to keep track of the location of trains, and any problems on the network.

After studying the rail network, the operator uses abstraction to create the virtual representation.

(i) Define the term 'abstraction'.

----- [1]

(ii) Identify **two** reasons why abstraction is needed in the rail network program.

1 -----

2 -----

----- [2]

(iii) Describe **one** potential difference between the virtual and real rail network.

----- [2]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		<ul style="list-style-type: none"> Abstraction is the process of separating ideas (1 – AO 1.1) from particular instances / reality (1 – AO 1.1). It is a means of hiding detail / only using relevant detail (1 – AO 1.1), it is a representation of reality (1 – AO 1.1), using symbols to show real-life features (1 – AO 2.1) or irrelevant features (e.g. such as buildings) left out (1 – AO 2.1). 	4	<p>Up to 4 marks for a valid definition.</p> <p>Up to 2 marks for demonstrating knowledge (AO1.1).</p> <p>Up to 2 marks for demonstrating application of knowledge and understanding (AO2.1).</p>
	b	i	<p>Examples:</p> <ul style="list-style-type: none"> Road / type of road symbol (1). Road number symbol (1). Colour coding (1). Place labels (1). 	3	1 mark for each correct identification up to a maximum of three identifications.
		ii	<ul style="list-style-type: none"> Software is modular (1), an example being an object / function (1). Modules can be transplanted into new software (1) or can be shared at run time (1) through the use of program libraries (1). 	3	Up to 3 marks for a valid explanation.
			Total	10	
2	a		<ul style="list-style-type: none"> A real town contains things that aren't relevant to the simulation (1) which would require unnecessary programming / design effort (1). ... would require extra computational resources ... (1). ... could detract from the main purpose of the program (1). 	2	Up to 2 marks for a valid explanation.

Question			Answer/Indicative content	Marks	Guidance
	b	i	<ul style="list-style-type: none"> • Road signs / road markings (1) – so the user can practise obeying these when driving (1). • Traffic Lights (1) – so user can practise obeying traffic light signals (1). • Zebra crossing (1) – so user can practise slowing down / stopping at zebra crossing (1). • Cars / vehicles (1) – so user can practice driving with other cars on the road (1). • Pedestrians (1) – so user can practice looking out for and avoiding pedestrians (1). 	4	1 mark for each correct identification up to a maximum of two identifications plus up to a further 1 mark for each of two valid explanations.
		ii	<ul style="list-style-type: none"> • Scenery may be simplified (1). • Smaller roads may be removed (1). • Potholes may be removed (1). • Buildings may be simplified (1). • Imperfections / wear / damage in road markings and signs will be ignored (1). • No need to worry about sounds of real town (1). 	2	1 mark for each correct identification up to a maximum of two identifications.
			Total	8	
3			e.g. <ul style="list-style-type: none"> • Reduces track scenery • Limited functionality on car dashboard • Simplified controls • Simplified physics • Simplified / removed weather 	2	Accept any reasonable answer Examiner's Comments Many candidates confused the concept of abstraction (simplification) with the requirement to make a genuinely realistic simulation.
			Total	2	

Question		Answer/Indicative content	Marks	Guidance
4		<p>Max 2 for description of abstraction, max 3 for examples.</p> <p>Description, max 2</p> <ul style="list-style-type: none"> • Remove unnecessary elements [1] • Reduce computational resources required [1] • Focus on the main purpose of program//does not detract from main purpose of program [1] <p>Examples, max 3, 1 mark per example e.g.</p> <ul style="list-style-type: none"> • Appearance of characters is replaced by object // a character is a stick man [1] • Places on the board are replaced with shapes and place name//e.g. a square that says 'town' rather than an actual town with buildings[1] • Scenery is removed // e.g. trees, rivers are not included [1] 	<p>4</p> <p>AO1.2 (4)</p>	<p>Allow any reasonable example that could be applied to the game</p> <p>Examiner's Comment: Most candidates knew what abstraction was and could give relevant examples of how it could be applied. Fewer could answer in depth to achieve full credit.</p>
		Total	4	

Question	Answer/Indicative content	Marks	Guidance
5	<p>Mark Band 3 – High level (7–9 marks)</p> <p>The candidate demonstrates a thorough knowledge and understanding of abstraction; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence / examples will be explicitly relevant to the explanation. <i>There is a well- developed line of reasoning which is clear and logically structured.</i> <i>The information presented is relevant and substantiated.</i></p> <p>Mark Band 2 – Mid level (4–6 marks)</p> <p>The candidate demonstrates reasonable knowledge and understanding of abstraction; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence / examples are for the most part implicitly relevant to the explanation. The candidate provides a reasonable discussion, the majority of which is focused. Evaluative comments are, for the most part appropriate, although one or two opportunities for development are missed. <i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1 – Low Level (1–3 marks)</p> <p>The candidate demonstrates a basic knowledge of abstraction with limited understanding shown; the material is basic and contains some inaccuracies. The candidates makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus.</p>	<p>9</p> <p>AO1.1 (2)</p> <p>AO1.2 (2)</p> <p>AO2.1 (2)</p> <p>AO3.3 (3)</p>	<p>AO1: Knowledge and Understanding Indicative content</p> <ul style="list-style-type: none"> • Removal of unnecessary elements • Uses symbols to represent elements of the problem • Increase chance of creating the program successfully • Reduces programming time and factors that can detract from the program <p>AO2: Application</p> <ul style="list-style-type: none"> • Examples of use in this system e.g. <ul style="list-style-type: none"> ◦ Environment is not shown ◦ Movements reduced / removed ◦ Other factors that can be done / affect the 'pet' are removed ◦ Time may not be represented as minutes, seconds <p>AO3: Evaluation</p> <ul style="list-style-type: none"> • Reduces complexity of programming • Requires less computational power, so the game can be played on lower spec devices e.g. phones • Focus is on the core aspects of the program rather than the extras • Too much abstraction can detract from the appeal of the game, may be too simplistic / not realistic enough, may not have enough scope to engage users

Question	Answer/Indicative content	Marks	Guidance
	<p>Judgements if made are weak and unsubstantiated. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No attempt to answer the question or response is not worthy of credit.</p>		<p>Examiner's Comment: Abstraction was well understood by the majority of candidates. Candidates needed to be able to give relevant examples in context and to be able to evaluate the advantages that abstraction gave to achieve marks in the top band. The level of clarity and analysis required for the top band was only seen in the strongest candidates' responses.</p>
	Total	9	

Question			Answer/Indicative content	Marks	Guidance
6		i	Removing characteristics/elements/detail from a problem	1 AO1.1 (1)	<u>Examiner's Comments</u> The term abstraction was well understood and clearly defined by most candidates.
		ii	1 mark per bullet to max 2 <ul style="list-style-type: none"> • Reduce processing requirements • Simplify programming • Reduce memory requirements 	2 AO1.2 (1) AO2.1 (1)	<u>Examiner's Comments</u> A number of candidates did not read the question clearly and responded by giving examples of abstraction rather than reasons for abstraction being used.
		iii	1 mark per identifying difference, 1 for expansion e.g. <ul style="list-style-type: none"> • Removal of feature • e.g. no stations/signals • Symbols/keys are used to represent elements • E.g. the train • May not be to scale • Relative distances may not be true 	2 AO2.1 (1) AO2.2 (1)	<u>Examiner's Comments</u> Many candidates could offer contextualised examples of differences between the real and the abstracted version of the system.
			Total	5	