AQA

A-level
COMPUTER SCIENCE

Paper 1

June 2017

Preliminary Material

To be opened and issued to candidates on or after 1 September 2016, subject to the instructions given in the Teachers' Notes (7517/1/TN).

Note

- The Preliminary Material and Skeleton Program are to be seen by candidates and their teachers **only**, for use during preparation for the examination on **Friday 16 June 2017**. It **cannot** be used by anyone else for any other purpose, other than that stated in the instructions issued, until after the examination date has passed. It must **not** be provided to third parties.

Information

- A Skeleton Program is provided separately by your teacher and must be read in conjunction with this Preliminary Material.
- You are advised to familiarise yourselves with the Preliminary Material and Skeleton Program before the examination.
- A copy of this Preliminary Material and the Skeleton Program will be made available to you in hardcopy and electronically at the start of the examination.
- You must **not** take any copy of the Preliminary Material, Skeleton Program or any other material into the examination room.

There is no Preliminary Material printed on this page

INSTRUCTIONS FOR CANDIDATES

The question paper is divided into **four sections** and a recommendation is given to candidates as to how long to spend on each section. Below are the recommended timings for the 2017 examination.

Section A
You are advised to spend no more than **45 minutes** on this section.
Questions will examine the specification content **not** specific to the **Preliminary Material**.

Section B
You are advised to spend no more than **20 minutes** on this section.
You will be asked to create a new program **not** related to the **Preliminary Material** or **Skeleton Program**.

Section C
You are advised to spend no more than **15 minutes** on this section.
Questions will refer to the **Preliminary Material** and the **Skeleton Program**, but will **not** require programming.

Section D
You are advised to spend no more than **70 minutes** on this section.
Questions will use the **Skeleton Program** and the **Preliminary Material**.

Electronic Answer Document

Answers for all questions for all sections must be entered into the word-processed document made available to the candidate at the start of the examination and referred to in the question paper rubrics as the **Electronic Answer Document**.

Preparation for the Examination

You should ensure that you are familiar with this **Preliminary Material** and the **Skeleton Program** for your programming language.

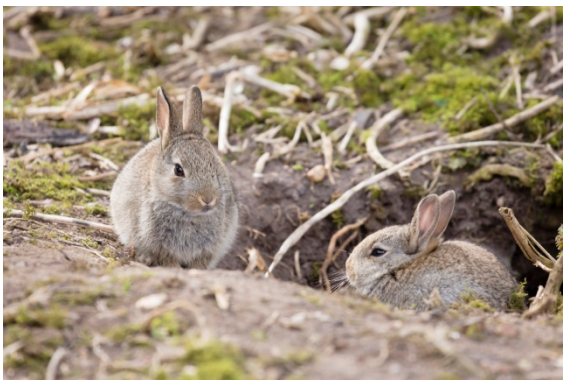
You should ensure that you are able to make modifications to the Skeleton Program that involve the use, in subclasses, of protected attributes and overridable methods from the `Animal` class.

RABBITS AND FOXES

Scientists are often interested in predicting how the population of a species of animal might change over time. Significant changes can have an impact on other animal species as well as on food production for humans. There are a huge number of factors that can impact on population, making it far too complex for us to be able to predict population changes with one hundred per cent accuracy in the real world. Scientists often develop computer models to try to predict how population may change over time; a computer model is an abstraction of a real world scenario. Scientists can use the computer model to make predictions about likely population changes in the real world. When a computer model is run it is called a simulation.

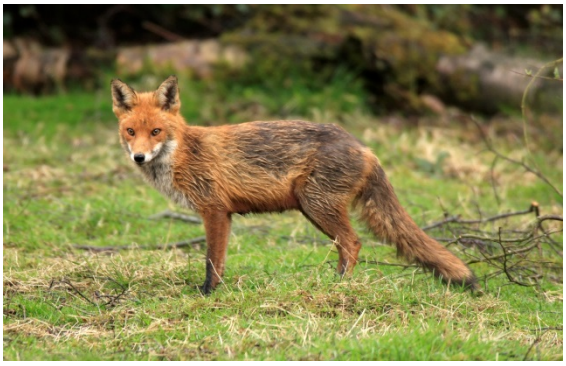
The more accurate the rules in the computer model are, the more reliable the predictions based on the outputs of the computer model will be.

The **Skeleton Program** accompanying this **Preliminary Material** is a program that models the population of rabbits and red foxes on an island.



Rabbits live in a collection of underground burrows called a warren.

They feed on grass and leafy plants. Rabbits breed at a fast rate and it is not unknown for rabbit populations to grow almost exponentially, which can cause significant ecological problems.



Red foxes tend to hunt for food on their own, ranging over a wide geographical area in their search for prey.

Red foxes will eat many different animals but rabbits are their main prey.

In the simulation in the **Skeleton Program** the island is represented by a square grid (the landscape). Each cell in the grid can contain either a rabbit warren or a fox or both. A rabbit warren is represented by a number that indicates the number of rabbits currently living in the warren and a fox is represented by the letter **F**.

Table 1 describes some of the data stored about each **fox**.

Table 1

Attribute	Description
ID	A unique number allocated to each animal.
Age	The fox's age in years (starting value is 0). If a fox does not get enough food it will age at a faster rate.
Natural lifespan	Indicates the age at which the fox will die of old age. If default values are used then the lifespan for each fox will be 7.
Probability of death from other causes	The percentage chance that, when the simulation is advanced to the next time period, the fox will die from a cause other than old age or lack of food (eg disease or being hit by a car). If default values are used then the probability of death from other causes for each fox will be 10%.
Food units needed	The number of rabbits the fox needs to eat in one time period to stay healthy. If default values are used then the food units needed for each fox will be 10.
Food units consumed	The number of rabbits the fox has eaten in the last time period. If a fox hasn't eaten any rabbits it will die. If a fox hasn't eaten as many rabbits as indicated by the food units needed attribute then the fox will age at a faster rate.

Table 2 describes some of the data stored about each **rabbit**.

Table 2

Attribute	Description
ID	A unique number allocated to each animal.
Age	The rabbit's age in years (starting value is 0).
Natural lifespan	Indicates the age at which the rabbit will die of old age. If default values are used then the lifespan for each rabbit will be 4.
Probability of death from other causes	The percentage chance that, when the simulation is advanced to the next time period, a rabbit will die from a cause other than old age or lack of food (eg being hit by a car or being eaten by a predator other than a fox). If default values are used then the probability of death from other causes for each rabbit will be 5%.
Reproduction rate	If default values are used then the reproduction rate for each rabbit will be 1.2. The higher the reproduction rate the higher the likelihood that this rabbit will mate with another rabbit (of a different gender) and have a kit (baby rabbit) that survives its first time period.
Gender	The gender of a rabbit. When a rabbit is born there is a 50% chance that it will be male and a 50% chance that it will be female.

Table 3 describes some of the data stored about each **warren**.

Table 3

Attribute	Description
Rabbits	A list containing all the rabbits currently living in the warren.
Periods run	The number of time periods that the warren has existed within the simulation.
Rabbit count	The number of rabbits currently living in the warren.
Already spread	This attribute indicates if the warren has already spread into a new warren. There is a maximum size of 99 for a warren (the maximum number of rabbits that can live in a warren) and when this value is reached for the first time a new warren is created at a random location in the landscape.

In the **Skeleton Program** there is a main menu containing three options.

The first option is to run the simulation with default settings. The second option is to run the simulation with custom settings. The third option is to exit the program.

If the user chooses to run the simulation with default settings then each rabbit and fox will have default values as described in **Table 1** and **Table 2**. The landscape will contain five warrens and five foxes, in the positions shown in **Figure 1**.

Figure 1

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0															
1		**38**					**F**								
2															
3											**52**				
4													**F**	**67**	
5															
6									**F**						
7										**20**					
8			**80**												
9															
10			**F**												
11															
12															
13												**F**			
14															

If the user chooses to run the simulation with custom settings then the user can choose the size of the landscape, the initial number of foxes, the initial number of warrens and the amount of variability to build into the model. The higher the variability chosen the more difference there will be between individual rabbits and individual foxes and the more difference there will be in the number of rabbits in each warren at the start of the simulation. Individual rabbits and foxes vary in terms of their lifespan, their probability of death from other causes, their reproduction rate (rabbits only) and the amount of food they need to eat (foxes only).

When the simulation is run (either using default or custom settings) the current state of the landscape is displayed and the user is shown a menu containing five options.

Option one is to advance the simulation to the next time period showing details about the changes that have happened to each warren and each fox.

Option two is to advance the simulation to the next time period but without showing details of the changes that have happened to the warrens and foxes.

Option three is to inspect a fox. When this option is chosen the user will be shown the details of the fox that is at coordinates specified by the user.

Option four is to inspect a warren. When this option is chosen the user will be shown the details of the warren that is at coordinates specified by the user. After the warren details have been displayed the user can also choose to view details about all the rabbits currently living in the warren.

Option five is to exit the simulation. When the user chooses this option they will be taken back to the program's main menu.

END OF PRELIMINARY MATERIAL

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