AS

Computer Science

Paper 1 (7516/1)

Mark scheme: applicable for **all** programming languages A, B, C, D and E

7516
June 2017

Version 1.0: Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

AS Computer Science

Paper 1 (**7516/1** – applicable to **all** programming languages A, B C, D and E)

June 2017

The following annotation is used in the mark scheme:

; - means a single mark
// - means alternative response
/ - means an alternative word or sub-phrase
A - means acceptable creditworthy answer
R - means reject answer as not creditworthy
NE - means not enough
I - means ignore
DPT - means "Don't penalise twice". In some questions a specific error made by a candidate, if repeated, could result in the loss of more than one mark. The **DPT** label indicates that this mistake should only result in a candidate losing one mark, on the first occasion that the error is made. Provided that the answer remains understandable, subsequent marks should be awarded as if the error was not being repeated.

Pages # to ## contain the generic mark scheme.

Pages ## to ## contain the program source code specific to the programming languages for questions ##,## and ##;

pages ## to ## – VB.NET
pages ## to ## – PYTHON 2
pages ## to ## – PYTHON 3
pages ## to ## – PASCAL/Delphi
pages ## to ## – C#
pages ## to ## – JAVA

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Examiners are required to assign each of the candidates' responses to the most appropriate level according to **its overall quality**, then allocate a single mark within the level. When deciding upon a mark in a level examiners should bear in mind the relative weightings of the assessment objectives

eg

In question **10.1**, the marks available for the AO3 elements are as follows:

AO3 (design) – 3 marks
AO3 (programming) – 6 marks

In question **11.1**, the marks available for the AO3 elements are as follows:

AO3 (design) – 3 marks
AO3 (programming) – 9 marks

Where a candidate's answer only reflects one element of the AO, the maximum mark they can receive will be restricted accordingly.

Qu			Marks
01	1	**All marks AO2 (apply)** **Event** / **Label(s)** Correct code keyed / F Door pulled open / B Door pushed shut / A New code keyed / E Press C / d, g (**I**. order) Press E / h, c (**I**. order) **1 mark** per two correct labels (round down). **I**. case **Note**: each label must only be used once (if given more than once, reject all occurrences).	4

<table>
<tr><th>Qu</th><th></th><th></th><th>Marks</th></tr>
<tr><td>02</td><td>1</td><td>
All marks AO2 (apply)
<table>
<tr><th>Count</th><th>HexString</th><th>Number</th><th>HexDigit</th><th>Value</th><th>Output</th></tr>
<tr><td>1</td><td>"A2"</td><td>0</td><td>"A"</td><td>10</td><td></td></tr>
<tr><td></td><td></td><td>10</td><td>"2"</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>162</td><td></td><td></td><td>162</td></tr>
<tr><td>2</td><td>"1G"</td><td>0</td><td>"1"</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>1</td><td>"G"</td><td>-1</td><td></td></tr>
<tr><td></td><td></td><td>15</td><td></td><td></td><td>15</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Mark as follows:

1. Count running over the values 1, 2 with correct sequence of values for HexString ("A2", "1G");
2. The correct sequence of values in Number column (0, 10, 162, 0, 1, 15);
3. The correct sequence of values in HexDigit column ("A", "2", "1", "G");
4. The correct sequence of values in Value column (10, 2, 1, −1);
5. The correct sequence of values in Output column (162, 15);

A. repeating values in first two columns
A. "1G" before "A2"
A. string values without quotes
</td><td>5</td></tr>
<tr><td>02</td><td>2</td><td>
All marks for AO2 (analyse)

1. invalid character produces value -1 from subroutine;
2. -1 should not be used to calculate // deal with -1 seperately // using -1 gives a misleading result;
3. final output should be -1 / error message;

MAX 2
</td><td>2</td></tr>
</table>

03	**1**	**All marks for AO3 (programming)** **Mark as follows:** 1. Correct prompts `"Enter a whole number: "` `"Enter another whole number: "` `Number1` and `Number2` assigned values entered by user; **R**. if inside loop 2. `Number1` and `Number2` assigned to `Temp1` and `Temp2` respectively; 3. `WHILE` loop with syntax allowed by the programming language and correct condition for termination of the loop; 4. Correct syntax and condition for the `IF` statement inside attempt at loop 5. Correct contents of `THEN` and `ELSE` part 6. Correct output `"… is GCF of … and …"` **A**. Temp1 instead of `Result` **A.** output on more than one line **R**. if inside loop **A**. variations on prompts **I.** minor differences in case and spelling **DPT**. If different identifiers	**6**

03	**2**	**Mark is for AO3 (evaluate)**
		
		****** SCREEN CAPTURE ******
		Must match code from 03.1, including prompts on screen capture matching those in code.
		Code for 03.1 must be sensible.
		
		Screen capture(s) showing the requested tests
		`>>>`
		`enter a whole number: 12`
		`enter another whole number: 39`
		`3  is GCF of  12  and  39`
		`>>>`
			1

03	**3**	**Mark is for AO2 (analyse)** to preserve the original values for later use // otherwise output won't make sense; *Note: must refer to the fact that original values are needed later*	**1**

04	**1**	**Mark is for AO1 (understanding)** `Frost // Continuing;` **R**. if any additional code **I.** minor differences in case and spelling **R**. significant differences in case and spelling	**1**
04	**2**	**Mark is for AO1 (understanding)** `GetHowLongToRun;` **R**. if any additional code **I.** minor differences in case and spelling **R**. significant differences in case and spelling	**1**
04	**3**	**Mark is for AO1 (understanding)** `Field;` **R**. `FieldRow` **R**. if any additional code **I.** minor differences in case and spelling **R**. significant differences in case and spelling	**1**
04	**4**	**Mark is for AO1 (understanding)** `Response // FileName // FieldRow;` **R**. if any additional code **I.** minor differences in case and spelling **R**. significant differences in case and spelling	**1**

05	**1**	**All marks for AO2 (analyse)** 1. (If the specification for the field size changes) only need to change the values at the beginning of the source code; 2. Makes the simulation/source code more understandable // improves readability of the code; **A**. easier to read 3. Makes clear that the values are the dimensions of the field // Identifiers convey meaning that the values directly don't; **A**. Can't change values accidentally; **MAX 2**	**2**
05	**2**	**Mark is for AO2 (analyse)** It checks that the coordinates of the proposed seed position are within the field boundaries // not outside the bounds of the field; **NE**. Validates seed position // stops generating an error	**1**
05	**3**	**All marks for AO2 (analyse)** 1. add another selection construct; 2. for rainfall equal to 1 (or 2); 3. when the plant count is exactly divisible by 4, change plant to soil; **A**. any method that guarantees killing of 25% of the plants **R**. random killing of plants **A**. equivalent code	**3**
05	**4**	**1 mark for AO1 (knowledge) and 1 mark for AO2 (apply)** **Mark as follows:** **AO1 (knowledge)** Integer division // Floor division // DIV; **A**. Division that always rounds down to the next integer; **NE**. division on its own **AO2 (apply)** Row = 10 Column = 17; **A**. 10, 17 // 17,10	**2**

06	**1**	**Mark is for AO2 (analyse)** `InitialiseField`; **I.** minor differences in case and spelling **R**. if any additional code	**1**
06	**2**	**Mark is for AO2 (analyse)** `ReadFile`; **A**. `CreateNewField` if not given in **06.3**; **I.** minor differences in case and spelling **R**. if any additional code	**1**
06	**3**	**Mark is for AO2 (analyse)** `CreateNewField`; **A.** `ReadFile` if not given in **06.2** **I.** minor differences in case and spelling **R**. if any additional code	**1**
06	**4**	**All marks for AO1 (understanding)** 1. Parameters/variables/values/data/arguments are passed; 2. Values are returned from a subroutine; **A**. reference parameters return updated values in Pascal; 3. Constants are available to all subroutines // **A.** global variables in Python; **MAX 2**	**2**

07	**1**	**All marks for AO2 (analyse)** 1. Program will load top-most/first rows read // bottom rows are ignored/not used; 2. Program will load left-most/first columns read // rightmost columns are ignored / not used; **A**. extra data beyond bounds of field are ignored for **2 marks** **A.** read data from top left corner, ignoring extra data for **2 marks** **A.** extra data is ignored for **1 mark**	**2**
07	**2**	**All marks for AO1 (understanding)** 1. Spring: every seed becomes a plant because there is no frost // every location contains "P"; 2. Summer: no change because there is no drought; 3. Autumn: no seed can land as there is no soil // no seed can land as every location contains "P"; **A**. no change because there is nowhere for seed to land; 4. Winter: only soil in the field // field will be empty;	**4**

08	**1**	**1 mark for AO3 (design) and 5 marks for AO3 (programming)** **Mark as follows:** **AO3 (design) – 1 mark:** 1. Identifying that an iterative statement is required to repeatedly input the data and check that it is valid before returning including a sensible attempt at termination logic; **A**. recursive method instead of iterative statement **AO3 (programming) – 4 marks:** 2. `'Invalid input'` is displayed for any one invalid input; **R**. if always displays error message 3. Function returns value for all valid inputs, and in no other circumstance; 4. test `Year` is in range -1 to 5; **R**. if zero excluded 5. test for non-integer input; **A**. test for one type of non-integer input (decimal or string) **I.** minor differences in case and spelling	**5**

08	**2**	**Mark is for AO3 (evaluate)**
		
		****** SCREEN CAPTURE ******
		Must match code from 08.1, including prompts on screen capture matching those in code.
		Code for 08.1 must be sensible.
		Screen capture(s) showing the requested test being performed and showing the message `'Invalid input'` for -2, 6, w, 1.4 but not for 0
		
		A. different error message (or none) if it matches 08.1
		`>>>`
		`Welcome to the Plant Growing Simulation`
		
		`You can step through the simulation a year at a time`
		`or run the simulation for 0 to 5 years`
		`How many years do you want the simulation to run?`
		`Enter a number between 0 and 5, or -1 for stepping mode: -2`
		`Invalid input`
		`Enter a number between 0 and 5, or -1 for stepping mode: 6`
		`Invalid input`
		`Enter a number between 0 and 5, or -1 for stepping mode: w`
		`Invalid input`
		`Enter a number between 0 and 5, or -1 for stepping mode: 1.4`
		`Invalid input`
		`Enter a number between 0 and 5, or -1 for stepping mode: 0`
		
		`>>>`
			1

09	**1**	**All marks for AO3 (programming)** **1.** show correct formula for calculating percentage; **2.** show correct method for rounding result; **A**. if it shows 15% (or 10%)	**2**
09	**2**	**Mark is for AO3 (evaluate)** ****** SCREEN CAPTURE ****** *Must match code from 09.1, including prompts on screen capture matching those in code.* *Code for 09.1 must be sensible.* Screen captures showing the requested test being performed; The first percentage must be 15%. This will be the only percentage. If there has been a frost (see example below) it should be 10% **A.** 0% if new field created and 09.1 correct **A**. truncated percentage Welcome to the Plant Growing Simulation You can step through the simulation a year at a time or run the simulation for 0 to 5 years How many years do you want the simulation to run? Enter a number between 0 and 5, or -1 for stepping mode: 1 Do you want to load a file with seed positions? (Y/N): Y Enter file name: TestCase.txt There are 103 plants growing 15 % There has been a frost There are 69 plants growing 10 % Season: spring Year number: 1 ......P.....| 0 .....X.....| 1 .....| 2 .....P.PP.PXP.PP.PP.PP.....| 3 .....| 4 .....P.P.....P.....| 5 .....P.....| 6 .....P.P.PP.PP.PPX.P.P.....| 7 .....P.....P.....| 8 ..X.....| 9 .....P.P.....P.P.....| 10 .....P.X.P..PP.P.P...P.....| 11 .....P...P.P.....P.P.....X.....| 12 .....P.P...P.P...P.P.....| 13 .....P.P...P...P...P.P.....| 14 .....PP.PP.....| 15 .....P.P.....P.P.....| 16	**1**

		.....XX.....P.....| 17 .....P.....P.P.....| 18 .....P.....| 19	

10	**1**	**3 marks for AO3 (design) and 6 marks for AO3 (programming)** **Note** that AO3 (design) marks are for selecting appropriate techniques to use to solve the problem, so should be credited whether the syntax of programming language statements is correct or not regardless of whether the solution works.	**9**

Level	Description	Mark Range
3	A line of reasoning has been followed to arrive at a logically structured working or almost fully working programmed solution. Code is written to ensure that all field cells are saved correctly. The formatting of each line has been considered. Appropriate messages are displayed. A formal interface is used to pass the `Field` data into the subroutine. Most of the appropriate design decisions have been taken.	7-9
2	There is evidence that a line of reasoning has been partially followed. `SaveToFile` subroutine has been created, but it might only contain code for saving the data without formatting. There is evidence of some appropriate design work.	4-6
1	An attempt has been made to create `SaveToFile` and some appropriate programming statements have been written. There is insufficient evidence to suggest that a line of reasoning has been followed or that the solution has been designed. The statements written may or may not be syntactically correct and the subroutine will have very little or none of the required functionality. It is unlikely that any of the key design elements of the task have been recognised.	1-3

Marking guidance:

AO3 (design) – 3 points

1. Identify the need for a selection statement to act on user response
2. Identify a method to save each array element
3. Identify a method for required formatting to right-align line numbers

AO3 (programming) – 6 points

4. subroutine header with correct parameter
   A. similar identifier to `SaveToFile`
5. user interaction to allow filename to be entered when save chosen
6. create a text file for writing
7. each array row output on a new line **R**. if new line as line 0
8. "|" and row number added to end of row
   A. without extra space after "|"
9. subroutine call in suitable place(s) in `Simulation` subroutine:
   Either: line above or below `"End of Simulation"`
   Or: after `FOR` loop **and** after or within `WHILE` loop

Refer answers using nested procedures to Team Leaders

10	**2**	**Mark is for AO3 (evaluate)**
		
		****** SCREEN CAPTURE ******
		Must match code from 10.1, including prompts on screen capture matching those in code.
		Code for 10.1 must be sensible.
		
		All screen captures must be present for mark to be awarded
		
		Screen captures showing the requested test being performed;
		
		screen capture must show prompt to save and prompt for file name
		
		`Season:  winter   Year number:  2`
		`.....|  0`
		`.....|  1`
		`.....|  2`
		`.....|  3`
		`.....|  4`
		`.....|  5`
		`.....|  6`
		`.....|  7`
		`.............SSSS.....|  8`
		`.............S..SS.....|  9`
		`.............S.S.S.....| 10`
		`.............SS..S.....| 11`
		`.............SSSS.....| 12`
		`.....| 13`
		`.....| 14`
		`.....| 15`
		`.....| 16`
		`.....| 17`
		`.....| 18`
		`.....| 19`
		
		`End of Simulation`
		`Save the current Field state to a text file? (Y/N): Y`
		`Enter the chosen filename to save your field data: Test1.txt`
		
		A. different filename
			1

10	**3**	**Mark is for AO3 (evaluate)**
		
		****** SCREEN CAPTURE ******
		Must match screen capture from 10.2 (allow for a frost)
		
		All screen captures must be present for mark to be awarded
		
		Screen captures showing the requested test being performed;
		
		`Welcome to the Plant Growing Simulation`
		
		`You can step through the simulation a year at a time`
		`or run the simulation for 0 to 5 years`
		`How many years do you want the simulation to run?`
		`Enter a number between 0 and 5, or -1 for stepping mode: 1`
		`Do you want to load a file with seed positions? (Y/N): Y`
		`Enter file name: Test1.txt`
		`There are 17 plants growing`
		`There has been a frost`
		`There are 12 plants growing`
		`Season: spring Year number: 1`
		`.....|  0`
		`.....|  1`
		`.....|  2`
		`.....|  3`
		`.....|  4`
		`.....|  5`
		`.....|  6`
		`.....|  7`
		`.....PP.P.....|  8`
		`.....P...P.....|  9`
		`.....P...P.....| 10`
		`.....P...P.....| 11`
		`.....P.PP.....| 12`
		`.....| 13`
		`.....| 14`
		`.....| 15`
		`.....| 16`
		`.....| 17`
		`.....| 18`
		`.....| 19`
			1

		if no frost: .....| 0 .....| 1 .....| 2 .....| 3 .....| 4 .....| 5 .....| 6 .....| 7 .....PPPP.....| 8 .....P..PP.....| 9 .....P.P.P.....| 10 .....PP..P.....| 11 .....PPPP.....| 12 .....| 13 .....| 14 .....| 15 .....| 16 .....| 17 .....| 18 .....| 19	

11	**1**	**3 marks for AO3 (design) and 9 marks for AO3 (programming)** **Note** that AO3 (design) marks are for selecting appropriate techniques to use to solve the problem, so should be credited whether the syntax of programming lanuage statements is correct or not regardless of whether the solution works.	**12**

Level	Description	Mark Range
3	A line of reasoning has been followed to arrive at a logically structured working or almost fully working programmed solution that is efficient. Code is written to ensure that all possible wind directions result in the displacement of the seeds. The Field cells are updated (mostly) correctly. The 'no wind' option has been considered. Appropriate messages are displayed. All of the appropriate design decisions have been taken.	9-12
2	There is evidence that a line of reasoning has been partially followed. `SimulateAutumn` has been adapted, but it might only contain code for some of the wind directions and displacements have not been used correctly with `SeedLands`. There is evidence of some appropriate design work.	5-8
1	An attempt has been made to alter `SimulateAutumn` and some appropriate programming statements have been written. There is insufficient evidence to suggest that a line of reasoning has been followed or that the solution has been designed. The statements written may or may not be syntactically correct and the subroutine will have very little or none of the required functionality. It is unlikely that any of the key design elements of the task have been recognised.	1-4

Marking guidance:

AO3 (design) – 3 points

1. identifying a method to associate each different random value with a different wind direction, including 'no wind'
2. identifying that a displacement needs to be added to row and/or column
3. identifying a method of solution that does not increase the number of calls to `SeedLands` and deals with more than one wind direction

AO3 (programming) – 9 points

4. setting up random number generator correctly generating 9 different values
5. displaying a message about wind in a sensible place in the code
6. correctly displays wind direction associated with the generated random number
7. correctly displaying alternative message when there was no wind
8. adjusting column correctly for east/west wind and leaving row unchanged
9. adjusting row correctly for north/south wind and leaving column unchanged
10. adjusting row and column correctly for one of NW / NE / SW / SE winds
11. adjusting row and column correctly for 2 or 3 of NW / NE / SW / SE winds
12. adjusting row and column correctly for all of NW / NE / SW / SE winds

DPT. If direction of wind is interpreted as blowing towards instead of coming from

None		N		S		E		W		NW		SW		NE		SE	
0	**0**	**1**	**0**	**-1**	**0**	**0**	**-1**	**0**	**1**	**1**	**1**	**-1**	**1**	**1**	**-1**	**-1**	**-1**
-1	-1	0	-1	-2	-1	-1	-2	-1	0	0	0	-2	0	0	-2	-2	-2
-1	0	0	0	-2	0	-1	-1	-1	+1	0	+1	-2	+1	0	-1	-2	-1
-1	+1	0	+1	-2	+1	-1	0	-1	+2	0	+2	-2	+2	0	0	-2	0
0	-1	+1	-1	-1	-1	0	-2	0	0	+1	0	-1	0	+1	-2	-1	-2
0	+1	+1	+1	-1	+1	0	0	0	+2	+1	+2	-1	+2	+1	0	-1	0
+1	-1	+2	-1	0	-1	+1	-2	+1	0	+2	0	0	0	+2	-2	0	-2
+1	0	+2	0	0	0	+1	-1	+1	+1	+2	+1	0	+1	+2	-1	0	-1
+1	+1	+2	+1	0	+1	+1	0	+1	+2	+2	+2	0	+2	+2	0	0	0

11	2	Mark is for AO3 (evaluate) **** SCREEN CAPTURE **** *Must match code from 11.1, including prompts on screen capture matching those in code.* *Code for 11.1 must be sensible.* Screen captures showing the requested test being performed; **Two autumns** need to be shown The screenshots should show the seeds relative to the plant as shown in the following (name of prevailing wind should match the displaced Seed positions relative to the Plant) Prevailing wind: **No wind** Season: autumn Year number: 1 .....| 0 .....| 1 .....| 2 .....| 3 .....| 4 .....| 5 .....| 6 .....| 7 .....| 8 .....SSS.....| 9 .....S**P**S.....| 10 .....SSS.....| 11 .....| 12 .....| 13 .....| 14 .....| 15 .....| 16 .....| 17 .....| 18 .....| 19 Prevailing wind: **North** Season: autumn Year number: 1 .....| 6 .....| 7 .....| 8 .....| 9 .....S**P**S.....| 10 .....S.S.....| 11 .....SSS.....| 12 .....| 13 .....| 14	1

```
Prevailing wind:  South
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
..................SSS................|  8
..................S.S................|  9
..................SPS................| 10
.....................................| 11
.....................................| 12
.....................................| 13
.....................................| 14

Prevailing wind:  East
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
.....................................|  8
..................SSS................|  9
..................S.P................| 10
..................SSS................| 11
.....................................| 12
.....................................| 13
.....................................| 14

Prevailing wind:  West
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
.....................................|  8
.................. SSS...............|  9
...................P.S...............| 10
...................SSS...............| 11
.....................................| 12
.....................................| 13
.....................................| 14

Prevailing wind:  NorthWest
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
.....................................|  8
.....................................|  9
...................PSS...............| 10
...................S.S...............| 11
...................SSS...............| 12
.....................................| 13
.....................................| 14


Prevailing wind:  Southwest
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
```

```
..................SSS.............|  8
.................S.S.............|  9
..................PSS.............| 10
.....................................| 11
.....................................| 12
.....................................| 13
.....................................| 14

Prevailing wind:  Northeast
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
.....................................|  8
.....................................|  9
.................SSP.................| 10
.................S.S.................| 11
.................SSS.................| 12
.....................................| 13
.....................................| 14

Prevailing wind:  Southeast
Season:  autumn   Year number:  1
.....................................|  6
.....................................|  7
.................SSS.................|  8
.................S.S.................|  9
.................SSP.................| 10
.....................................| 11
.....................................| 12
.....................................| 13
.....................................| 14
```

Python 2

03	**1**	`Number1 = int(raw_input("Enter a whole number: "))`
		`Number2 = int(raw_input("Enter another whole number: "))`
		`Temp1 = Number1`
		`Temp2 = Number2`
		`while Temp1 != Temp2:`
		`  if Temp1 > Temp2:`
		`  Temp1 = Temp1 - Temp2`
		`  else:`
		`  Temp2 = Temp2 - Temp1`
		`Result = Temp1`
		`print Result, " is GCF of ", Number1, " and ", Number2`
			6

08	**1**	`def GetHowLongToRun():`
		`  print "Welcome to the Plant Growing Simulation"`
		`  print`
		`  print "You can step through the simulation a year at a time"`
		`  print "or run the simulation for 0 to 5 years"`
		`  print "How many years do you want the simulation to run?"`
		`  Valid = False`
		`  while not Valid:`
		`  try: # catch non-integer input`
		`  Years = int(raw_input("Enter a number between 0 and 5, or -1 for stepping mode: "))`
		`  if Years >= -1 and Years <= 5:`
		`  Valid = True`
		`  except:`
		`  pass`
		`  if not Valid:`
		`  print "Invalid input"`
		`  return Years`
			5

09	**1**	`def CountPlants(Field):`
		`  NumberOfPlants = 0`
		`  for Row in range(FIELDLENGTH):`
		`  for Column in range(FIELDWIDTH):`
		`  if Field[Row][Column] == PLANT:`
		`  NumberOfPlants += 1`
		`  if NumberOfPlants == 1:`
		`  print "There is 1 plant growing"`
		`  else:`
		`  print "There are", NumberOfPlants, "plants growing"`
		`  TotalCells = FIELDWIDTH * FIELDLENGTH`
		`  Percentage = int(round((NumberOfPlants * 100.0) / TotalCells))`
		`  print Percentage , "%"`
			2

10	**1**	**def SaveToFile(Field):**
		** Response = raw_input('Save the current Field state to a text file? (Y/N): ')**
		** if Response == 'Y':**
		** FileName = raw_input('Enter the chosen filename to save your field data: ')**
		** FileHandle = open(FileName, 'w')**
		** for Row in range(FIELDLENGTH):**
		** for Column in range(FIELDWIDTH):**
		** FileHandle.write(Field[Row][Column])**
		** FileHandle.write('|{0:>3}'.format(Row))**
		** FileHandle.write('\n')**
		** FileHandle.close()**
		
		def Simulation():
		  YearsToRun = GetHowLongToRun()
		  if YearsToRun != 0:
		  Field = InitialiseField()
		  if YearsToRun >= 1:
		  for Year in range(1, YearsToRun + 1):
		  SimulateOneYear(Field, Year)
		  else:
		  Continuing = True
		  Year = 0
		  while Continuing:
		  Year += 1
		  SimulateOneYear(Field, Year)
		  Response = raw_input("Press Enter to run simulation for another Year, Input X to stop: ")
		  if Response == "x" or Response == "X":
		  Continuing = False
		  print "End of Simulation"
		  SaveToFile(Field)
		  raw_input()
			9

11	**1**	def SimulateAutumn(Field):
		  Direction = ['None', 'East', 'West', 'North', 'South', 'Southeast','Northeast','Southwest','Northwest']
		  PrevailingWind = randint(0,8)
		  WindDirection = Direction[PrevailingWind]
		  ColumnDisplacement = 0
		  RowDisplacement = 0
		  if WindDirection == 'East':
		  ColumnDisplacement = -1
		  elif WindDirection == 'West':
		  ColumnDisplacement = 1
		  elif WindDirection == 'North':
			12

```
    RowDisplacement = 1
  elif WindDirection == 'South':
    RowDisplacement = -1
  elif WindDirection == 'Southeast':
    RowDisplacement = -1
    ColumnDisplacement = -1
  elif WindDirection == 'Northeast':
    RowDisplacement = 1
    ColumnDisplacement = -1
  elif WindDirection == 'Southwest':
    RowDisplacement = -1
    ColumnDisplacement = 1
  elif WindDirection == 'Northwest':
    RowDisplacement = 1
    ColumnDisplacement = 1
  if PrevailingWind == 0:
    print 'There was no wind this season'
  else:
    print 'Prevailing wind: ', WindDirection
  for Row in range(FIELDLENGTH):
    for Column in range(FIELDWIDTH):
      if Field[Row][Column] == PLANT:
        Row = Row + RowDisplacement
        Column = Column + ColumnDisplacement
        Field = SeedLands(Field, Row - 1, Column - 1)
        Field = SeedLands(Field, Row - 1, Column)
        Field = SeedLands(Field, Row - 1, Column + 1)
        Field = SeedLands(Field, Row, Column - 1)
        Field = SeedLands(Field, Row, Column + 1)
        Field = SeedLands(Field, Row + 1, Column - 1)
        Field = SeedLands(Field, Row + 1, Column)
        Field = SeedLands(Field, Row + 1, Column + 1)
  return Field
```

Python 3

03	**1**	`Number1 = int(input("Enter a whole number: "))`
		`Number2 = int(input("Enter another whole number: "))`
		`Temp1 = Number1`
		`Temp2 = Number2`
		`while Temp1 != Temp2:`
		`  if Temp1 > Temp2:`
		`  Temp1 = Temp1 - Temp2`
		`  else:`
		`  Temp2 = Temp2 - Temp1`
		`Result = Temp1`
		`print(Result, " is GCF of ", Number1, " and ", Number2)`
			6

08	**1**	`def GetHowLongToRun():`
		`  print('Welcome to the Plant Growing Simulation')`
		`  print()`
		`  print('You can step through the simulation a year at a time')`
		`  print('or run the simulation for 0 to 5 years')`
		`  print('How many years do you want the simulation to run?')`
		`  Valid = False`
		`  while not Valid:`
		`  try: # catch non-integer input`
		`  Years = int(input('Enter a number between 0 and 5, or -1 for stepping mode: '))`
		`  if Years >= -1 and Years <= 5:`
		`  Valid = True`
		`  except:`
		`  pass`
		`  if not Valid:`
		`  print('Invalid input')`
		`  return Years`
			5

09	**1**	`def CountPlants(Field):`
		`  NumberOfPlants = 0`
		`  for Row in range(FIELDLENGTH):`
		`  for Column in range(FIELDWIDTH):`
		`  if Field[Row][Column] == PLANT:`
		`  NumberOfPlants += 1`
		`  if NumberOfPlants == 1:`
		`  print('There is 1 plant growing')`
		`  else:`
		`  print('There are', NumberOfPlants, 'plants growing')`
		`  TotalCells = FIELDWIDTH * FIELDLENGTH`
		`  Percentage = round((NumberOfPlants / TotalCells)* 100)`
		`  print(Percentage, '%')`
			2

10	**1**	**def SaveToFile(Field):**
		** Response = input('Save the current Field state to a text file? (Y/N): ')**
		** if Response == 'Y':**
		** FileName = input('Enter the chosen filename to save your field data: ')**
		** FileHandle = open(FileName, 'w')**
		** for Row in range(FIELDLENGTH):**
		** for Column in range(FIELDWIDTH):**
		** FileHandle.write(Field[Row][Column])**
		** FileHandle.write('|{0:>3}'.format(Row))**
		** FileHandle.write('\n')**
		** FileHandle.close()**
		
		def Simulation():
		  YearsToRun = GetHowLongToRun()
		  if YearsToRun != 0:
		  Field = InitialiseField()
		  if YearsToRun >= 1:
		  for Year in range(1, YearsToRun + 1):
		  SimulateOneYear(Field, Year)
		  else:
		  Continuing = True
		  Year = 0
		  while Continuing:
		  Year += 1
		  SimulateOneYear(Field, Year)
		  Response = input('Press Enter to run simulation for another Year, Input X to stop: ')
		  if Response == 'x' or Response == 'X':
		  Continuing = False
		  print('End of Simulation')
		  SaveToFile(Field)
		  input()
			9

11	**1**	`def SimulateAutumn(Field):`
		`  Direction = ['None', 'East', 'West', 'North', 'South',`
		`  'Southeast','Northeast','Southwest','Northwest']`
		`  PrevailingWind = randint(0,8)`
		`  WindDirection = Direction[PrevailingWind]`
		`  ColumnDisplacement = 0`
		`  RowDisplacement = 0`
		`  if WindDirection == 'East':`
		`  ColumnDisplacement = -1`
		`  elif WindDirection == 'West':`
		`  ColumnDisplacement = 1`
		`  elif WindDirection == 'North':`
		`  RowDisplacement = 1`
		`  elif WindDirection == 'South':`
		`  RowDisplacement = -1`
		`  elif WindDirection == 'Southeast':`
		`  RowDisplacement = -1`
		`  ColumnDisplacement = -1`
		`  elif WindDirection == 'Northeast':`
		`  RowDisplacement = 1`
		`  ColumnDisplacement = -1`
		`  elif WindDirection == 'Southwest':`
		`  RowDisplacement = -1`
		`  ColumnDisplacement = 1`
		`  elif WindDirection == 'Northwest':`
		`  RowDisplacement = 1`
		`  ColumnDisplacement = 1`
		`  if PrevailingWind == 0:`
		`  print('There was no wind this season')`
		`  else:`
		`  print('Prevailing wind: ', WindDirection)`
		`  for Row in range(FIELDLENGTH):`
		`  for Column in range(FIELDWIDTH):`
		`  if Field[Row][Column] == PLANT:`
		`  Row = Row + RowDisplacement`
		`  Column = Column + ColumnDisplacement`
		`  Field = SeedLands(Field, Row - 1, Column - 1)`
		`  Field = SeedLands(Field, Row - 1, Column)`
		`  Field = SeedLands(Field, Row - 1, Column + 1)`
		`  Field = SeedLands(Field, Row, Column - 1)`
		`  Field = SeedLands(Field, Row, Column + 1)`
		`  Field = SeedLands(Field, Row + 1, Column - 1)`
		`  Field = SeedLands(Field, Row + 1, Column)`
		`  Field = SeedLands(Field, Row + 1, Column + 1)`
		`  return Field`
			12

Alternative answer

```
def SimulateAutumn(Field):
  Direction = ['None', 'East', 'West', 'North', 'South',
       'Southeast','Northeast','Southwest','Northwest']
  PrevailingWind = randint(0,8)
  WindDirection = Direction[PrevailingWind]
  ColumnDisplacement = 0
  RowDisplacement = 0
  if WindDirection == 'East':
    ColumnDisplacement = -1
  elif WindDirection == 'West':
    ColumnDisplacement = 1
  elif WindDirection == 'North':
    RowDisplacement = 1
  elif WindDirection == 'South':
    RowDisplacement = -1
  elif WindDirection == 'Southeast':
    RowDisplacement = -1
    ColumnDisplacement = -1
  elif WindDirection == 'Northeast':
    RowDisplacement = 1
    ColumnDisplacement = -1
  elif WindDirection == 'Southwest':
    RowDisplacement = -1
    ColumnDisplacement = 1
  elif WindDirection == 'Northwest':
    RowDisplacement = 1
    ColumnDisplacement = 1
  if PrevailingWind == 0:
    print('There was no wind this season')
  else:
    print('Prevailing wind: ', WindDirection)
  for Row in range(FIELDLENGTH):
    for Column in range(FIELDWIDTH):
      if Field[Row][Column] == PLANT:
        Field = SeedLands(Field, Row - 1 +
RowDisplacement, Column - 1 + ColumnDisplacement)
        Field = SeedLands(Field, Row - 1 +
RowDisplacement, Column + ColumnDisplacement)
        Field = SeedLands(Field, Row - 1 +
RowDisplacement, Column + 1 + ColumnDisplacement)
        Field = SeedLands(Field, Row + RowDisplacement,
Column - 1 + ColumnDisplacement)
        Field = SeedLands(Field, Row + RowDisplacement,
Column + 1 + ColumnDisplacement)
        Field = SeedLands(Field, Row + 1 +
RowDisplacement, Column - 1 + ColumnDisplacement)
```

```
        Field = SeedLands(Field, Row + 1 +
RowDisplacement, Column + ColumnDisplacement)
        Field = SeedLands(Field, Row + 1 +
RowDisplacement, Column + 1 + ColumnDisplacement)
  return Field
```

VB.NET

03 **1** **6**

```
Sub Main()
  Dim Number1 As Integer
  Dim Number2 As Integer
  Dim Temp1 As Integer
  Dim Temp2 As Integer
  Dim Result As Integer
  Console.Write("Enter a whole number: ")
  Number1 = Console.ReadLine
  Console.Write("Enter another whole number: ")
  Number2 = Console.ReadLine
  Temp1 = Number1
  Temp2 = Number2
  While Temp1 <> Temp2
    If Temp1 > Temp2 Then
      Temp1 = Temp1 - Temp2
    Else
      Temp2 = Temp2 - Temp1
    End If
  End While
  Result = Temp1
  Console.WriteLine(Result & " is GCF of " & Number1 & " and " &
Number2)
  Console.ReadLine()
End Sub
```

08 **1** **5**

```
...
Console.WriteLine("How many years do you want the simulation to
run?")
Dim Valid As Boolean = False
While Not Valid
  Try
    Console.Write("Enter a number between 0 and 5, or -1 for
stepping mode: ")
      Years = Convert.ToInt32(Console.ReadLine());
    If Years >= -1 And Years <= 5 Then
      Valid = True
    End If
  Catch
  End Try
  If Not Valid Then
    Console.WriteLine("Invalid input")
  End If
End While
Return Years
...
```

Alternative answer

```
...
Console.WriteLine("How many years do you want the simulation to
run?")
While True
  Try
    Console.Write("Enter a number between 0 and 5, or -1 for
stepping: ")
      Years = Convert.ToInt32(Console.ReadLine());
```

		`    If Years >= -1 And Years <= 5 Then`
		`      Exit While`
		`    End If`
		`  Catch`
		`  End Try`
		`  Console.WriteLine("Invalid input")`
		`End While`
		`Return Years`
		`...`	

09	**1**	`...`
		`  Console.WriteLine("There are " & NumberOfPlants & " plants growing")`
		`End If`
		`Dim TotalCells As Integer`
		`Dim Percentage As Integer`
		`TotalCells = FIELDWIDTH * FIELDLENGTH`
		`Percentage = Math.Round((NumberOfPlants / TotalCells) * 100)`
		`Console.WriteLine(Percentage & "%")`
		`...`
		
		Alternative answer
		
		`...`
		`  Console.WriteLine("There are " & NumberOfPlants & " plants growing")`
		`End If`
		`Console.WriteLine(Math.Round((NumberOfPlants / (FIELDWIDTH * FIELDLENGTH)) * 100) & "%")`
		`...`
			2

10	**1**	`Sub SaveToFile(ByVal Field(,) As Char)`
		`  Dim Response As String`
		`  Dim Row As Integer`
		`  Dim Column As Integer`
		`  Dim FileName As String`
		`  Dim FileHandle As IO.StreamWriter`
		`  Console.Write("Save the current Field state to a text file? (Y/N): ")`
		`  Response = Console.ReadLine()`
		`  If Response = "Y" Then`
		`    Console.Write("Enter the chosen filename to save your field data: ")`
		`    FileName = Console.ReadLine()`
		`    FileHandle = New IO.StreamWriter(FileName)`
		`    For Row = 0 To FIELDLENGTH - 1`
		`      For Column = 0 To FIELDWIDTH - 1`
		`        FileHandle.write(Field(Row, Column))`
		`      Next`
		`      FileHandle.Write("|" & Str(Row).PadLeft(3) & vbCrLf)`
		`    Next`
		`    FileHandle.close()`
		`  End If`
		`End Sub`
		
		`Sub Simulation()`
			9

```
  Dim YearsToRun As Integer
  Dim Continuing As Boolean
  Dim Response As String
  Dim Year As Integer
  Dim Field(FIELDWIDTH, FIELDLENGTH) As Char
  While True
    YearsToRun = GetHowLongToRun()
    If YearsToRun <> 0 Then
      Field = InitialiseField()
      If YearsToRun >= 1 Then
        For Year = 1 To YearsToRun
          SimulateOneYear(Field, Year)
        Next
      Else
        Continuing = True
        Year = 0
        While Continuing
          Year += 1
          SimulateOneYear(Field, Year)
          Console.Write("Press Enter to run simulation for another
Year, Input X to stop: ")
          Response = Console.ReadLine()
          If Response = "x" Or Response = "X" Then
            Continuing = False
          End If
        End While
      End If
      Console.WriteLine("End of Simulation")
      SaveToFile(Field)
    End If
    Console.ReadLine()
  End While
End Sub
```

11 **1**

```
Function SimulateAutumn(ByVal Field(,) As Char) As Char(,)
  Dim RowDisplacement As Integer
  Dim ColumnDisplacement As Integer
  Dim PrevailingWind As Integer
  Dim WindDirection As String
  Dim Direction() As String = {"None", "East", "West", "North",
"South", "Southeast", "Northeast", "Southwest", "Northwest"}
  PrevailingWind = Int(Rnd() * 10)
  WindDirection = Direction(PrevailingWind)
  ColumnDisplacement = 0
  RowDisplacement = 0
  If WindDirection = "East" Then
    ColumnDisplacement = -1
  ElseIf WindDirection = "West" Then
    ColumnDisplacement = 1
  ElseIf WindDirection = "North" Then
    RowDisplacement = 1
  ElseIf WindDirection = "South" Then
    RowDisplacement = -1
  ElseIf WindDirection = "Southeast" Then
    RowDisplacement = -1
    ColumnDisplacement = -1
  ElseIf WindDirection = "Northeast" Then
    RowDisplacement = 1
```

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```
    ColumnDisplacement = -1
  ElseIf WindDirection = "Southwest" Then
    RowDisplacement = -1
    ColumnDisplacement = 1
  ElseIf WindDirection = "Northwest" Then
    RowDisplacement = 1
    ColumnDisplacement = 1
  End If
  If PrevailingWind = 0 Then
    Console.WriteLine("There was no wind this season")
  Else
    Console.WriteLine("Prevailing wind: " & WindDirection)
  End If
  For Row = 0 To FIELDLENGTH - 1
    For Column = 0 To FIELDWIDTH - 1
      If Field(Row, Column) = Plant Then
        Field = SeedLands(Field, Row + RowDisplacement - 1, Column +
ColumnDisplacement - 1)
        Field = SeedLands(Field, Row + RowDisplacement - 1, Column +
ColumnDisplacement)
        Field = SeedLands(Field, Row + RowDisplacement - 1, Column +
ColumnDisplacement + 1)
        Field = SeedLands(Field, Row + RowDisplacement, Column +
ColumnDisplacement - 1)
        Field = SeedLands(Field, Row + RowDisplacement, Column +
ColumnDisplacement + 1)
        Field = SeedLands(Field, Row + RowDisplacement + 1, Column +
ColumnDisplacement - 1)
        Field = SeedLands(Field, Row + RowDisplacement + 1, Column +
ColumnDisplacement)
        Field = SeedLands(Field, Row + RowDisplacement + 1, Column +
ColumnDisplacement + 1)
      End If
    Next
  Next
  Return Field
End Function
```

Pascal

03	**1**	`program Project2;`
		
		`{$APPTYPE CONSOLE}`
		
		`uses`
		`  SysUtils;`
		
		`var`
		`  Number1, Number2 : Integer;`
		`  Temp1, Temp2 : Integer;`
		`  Result : Integer;`
		`begin`
		`  Write('Enter a whole number: ');`
		`  Readln(Number1);`
		`  Write('Enter another whole number: ');`
		`  Readln(Number2);`
		`  Temp1 := Number1;`
		`  Temp2 := Number2;`
		`  while Temp1 <> Temp2 do`
		`  if Temp1 > Temp2 then`
		`  Temp1 := Temp1 - Temp2`
		`  else`
		`  Temp2 := Temp2 - Temp1;`
		`  Result := Temp1;`
		`  Write(Result, ' is GCF of ', Number1, ' and ', Number2);`
		`  Readln;`
		`end.`
			6

08	**1**	`Function GetHowLongToRun() : Integer;`
		`Var`
		`  **Valid : Boolean;**`
		`  Years : Integer;`
		`Begin`
		`  Writeln('Welcome to the Plant Growing Simulation');`
		`  Writeln;`
		`  Writeln('You can step through the simulation a year at a time');`
		`  Writeln('or run the simulation for 0 to 5 years');`
		`  Writeln('How many years do you want the simulation to run?');`
		`  **Valid := False;**`
		`  **While Not Valid Do**`
		`  **Begin**`
		`  **Try**`
		`  Write('Enter a number between 0 and 5, or -1 for stepping mode: ');`
		`  Readln(Years);`
		`  **If (Years >= -1) And (Years <= 5) Then**`
		`  **Valid := True;**`
		` **Except**
			5

		End;
		If Not Valid Then
		Writeln('Invalid input');
		End;
		GetHowLongToRun := Years;
		End;	

09	**1**	Procedure CountPlants(Field : TField);
		Var
		TotalCells, Percentage : Integer;
		NumberOfPlants : Integer;
		Row, Column : Integer;
		Begin
		NumberOfPlants := 0;
		For Row := 0 To FIELDLENGTH - 1 Do
		For Column := 0 To FIELDWIDTH - 1 Do
		If Field[Row][Column] = PLANT Then
		NumberOfPlants := NumberOfPlants + 1;
		If NumberOfPlants = 1 Then
		Writeln('There is 1 plant growing')
		Else
		Writeln('There are ', NumberOfPlants, ' plants growing');
		TotalCells := FIELDWIDTH * FIELDLENGTH;
		Percentage := Round((NumberOfPlants / TotalCells) * 100);
		Writeln(Percentage, '%');
		End;
			2

10	**1**	**Procedure SaveToFile(Field : TField);**
		Var
		Response : Char;
		Row, Column : Integer;
		FileName : String;
		FileHandle : Text;
		Begin
		Write('Save the current Field state to a text file? (Y/N): ');
		Readln(Response);
		If Response = 'Y' Then
		Begin
		Write('Enter the chosen filename to save your field data: ');
		Readln(FileName);
		AssignFile(FileHandle, FileName);
		ReWrite(FileHandle);
		For Row := 0 To FIELDLENGTH - 1 Do
		Begin
		For Column := 0 To FIELDWIDTH - 1 Do
		Write(FileHandle, Field[Row][Column]);
		Writeln(FileHandle, '|', Row:3);
		End;
		CloseFile(FileHandle);
			9

```
  End;
End;

Procedure Simulation();
Var
  YearsToRun, Year : Integer;
  Field : TField;
  Continuing : Boolean;
  Response : String;
Begin
  YearsToRun := GetHowLongToRun();
  If YearsToRun <> 0 Then
  Begin
    Field := InitialiseField();
    If YearsToRun >= 1 Then
      For Year := 1 To YearsToRun Do
        SimulateOneYear(Field, Year)
    Else
    Begin
      Continuing := True;
      Year := 0;
      While Continuing = True Do
      Begin
        Year := Year + 1;
        SimulateOneYear(Field, Year);
        Write('Press Enter to run simulation for another
Year, Input X to stop: ');
        Readln(Response);
        If (Response = 'x') Or (Response = 'X') Then
          Continuing := False;
      End;
    End;
    Writeln('End of Simulation');
    SaveToFile(Field);
  End;
  Readln;
End;
```

11 **1**

```
Function SimulateAutumn(Field : TField) : TField;
Var
  PrevailingWind, ColumnDisplacement, RowDisplacement, Row,
Column : Integer;
  WindDirection : String;
  Direction : Array [0..8] Of String;
Begin
  Direction[0] := 'None';
  Direction[1] := 'East';
  Direction[2] := 'West';
  Direction[3] := 'North';
  Direction[4] := 'South';
  Direction[5] := 'Southeast';
  Direction[6] := 'Northeast';
```

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```
  Direction[7] := 'Southwest';
  Direction[8] := 'Northwest';
  PrevailingWind := Random(9);
  WindDirection := Direction[PrevailingWind];
  ColumnDisplacement := 0;
  RowDisplacement := 0;
  Case PrevailingWind of
  1 : ColumnDisplacement := -1;
  2 : ColumnDisplacement := 1;
  3 : RowDisplacement := 1;
  4 : RowDisplacement := -1;
  5 : Begin
        RowDisplacement := -1;
        ColumnDisplacement := -1;
      End;
  6 : Begin
        RowDisplacement := 1;
        ColumnDisplacement := -1;
      End;
  7 : Begin
        RowDisplacement := -1;
        ColumnDisplacement := 1;
      End;
  8 : Begin
        RowDisplacement := 1;
        ColumnDisplacement := 1;
      End;
  End;
  If PrevailingWind = 0 Then
    Writeln('There was no wind this season')
  Else
    Writeln('Prevailing wind: ', WindDirection);

  For Row := 0 To FIELDLENGTH - 1 Do
    For Column := 0 To FIELDWIDTH - 1 Do
      If Field[Row][Column] = PLANT Then
      Begin
        Field := SeedLands(Field, Row + RowDisplacement - 1,
Column + ColumnDisplacement - 1);
        Field := SeedLands(Field, Row + RowDisplacement - 1,
Column + ColumnDisplacement);
        Field := SeedLands(Field, Row + RowDisplacement - 1,
Column + ColumnDisplacement + 1);
        Field := SeedLands(Field, Row + RowDisplacement,
Column + ColumnDisplacement - 1);
        Field := SeedLands(Field, Row + RowDisplacement,
Column + ColumnDisplacement + 1);
        Field := SeedLands(Field, Row + RowDisplacement + 1,
Column + ColumnDisplacement - 1);
        Field := SeedLands(Field, Row + RowDisplacement + 1,
Column + ColumnDisplacement);
        Field := SeedLands(Field, Row + RowDisplacement + 1,
Column + ColumnDisplacement + 1);
```

```
      End;
  SimulateAutumn := Field;
End;
```

C#

03	**1**	`static void Main(string[] args)`
		`{`
		`  int Number1 = 0, Number2 = 0;`
		`  int Temp1 = 0, Temp2 = 0;`
		`  int Result = 0;`
		
		`  Console.Write("Enter a whole number: ");`
		`  Number1 = Convert.ToInt32(Console.ReadLine());`
		`  Console.Write("Enter another whole number: ");`
		`  Number2 = Convert.ToInt32(Console.ReadLine());`
		`  Temp1 = Number1;`
		`  Temp2 = Number2;`
		`  while (Temp1 != Temp2)`
		`  {`
		`  if (Temp1 > Temp2)`
		`  {`
		`  Temp1 = Temp1 - Temp2;`
		`  }`
		`  else`
		`  {`
		`  Temp2 = Temp2 - Temp1;`
		`  }`
		`  }`
		`  Result = Temp1;`
		`  Console.WriteLine(Result + " is GCF of " + Number1 + " and " + Number2 );`
		`  Console.ReadLine();`
		`}`
			6

08	**1**	`static int GetHowLongToRun()`
		`{`
		`  int Years = 0;`
		`  **bool Valid = false;**`
		`  Console.WriteLine("Welcome to the Plant Growing Simulation");`
		`  Console.WriteLine();`
		`  Console.WriteLine("You can step through the simulation a year at a time");`
		`  Console.WriteLine("or run the simulation for 0 to 5 years");`
		`  Console.WriteLine("How many years do you want the simulation to run?");`
		`  Console.Write("Enter a number between 0 and 5, or -1 for stepping mode: ");`
		`  **while (!Valid)**`
		`  **{**`
		`  **try**`
		`  **{**`
		`  Years = Convert.ToInt32(Console.ReadLine());`
			5

		`      if (Years >= -1 && Years <= 5)`
		`      {`
		`        Valid = true;`
		`      }`
		`    }`
		`    catch (Exception)`
		`    {`
		`    }`
		`    if (!Valid)`
		`    {`
		`      Console.WriteLine("Invalid input");`
		`    }`
		`  }`
		`  return Years;`
		`}`	

09	**1**	`static void CountPlants(char[,] Field)`
		`{`
		`  int NumberOfPlants = 0;`
		`  int TotalCells = 0;`
		`  double Percentage = 0;`
		`  for (int Row = 0; Row < FIELDLENGTH; Row++)`
		`  {`
		`    for (int Column = 0; Column < FIELDWIDTH; Column++)`
		`    {`
		`      if (Field[Row, Column] == PLANT)`
		`      {`
		`        NumberOfPlants++;`
		`      }`
		`    }`
		`  }`
		`  if (NumberOfPlants == 1)`
		`  {`
		`    Console.WriteLine("There is 1 plant growing");`
		`  }`
		`  else`
		`  {`
		`    Console.WriteLine("There are " + NumberOfPlants + "`
		`plants growing");`
		`  }`
		`  TotalCells = FIELDLENGTH * FIELDWIDTH;`
		`  Percentage = (((double)NumberOfPlants / (double)TotalCells)`
		`* 100.0);`
		`  Console.WriteLine(Math.Round(Percentage) + "%");`
		`}`
			2

10	**1**	`private static void SaveToFile(char[,] Field)`
		`{`
		`  string Response = "", FileName = "";`
		`  Console.Write("Save the current Field state to a text file?`
		`(Y/N):");`
			9

```
  Response = Console.ReadLine();
  if (Response == "Y")
  {
    Console.Write("Enter the File Name ");
    FileName = Console.ReadLine();
    StreamWriter CurrentFile = new StreamWriter(FileName);
    for (int Row = 0; Row < FIELDLENGTH; Row++)
    {
      for (int Column = 0; Column < FIELDWIDTH; Column++)
      {
        CurrentFile.Write(Field[Row, Column]);
      }
      CurrentFile.WriteLine("| " + String.Format("{0,3}",
Row));
    }
    CurrentFile.Close();
  }
}

static void Simulation()
{
  int YearsToRun;
  char[,] Field = new char[FIELDLENGTH, FIELDWIDTH];
  bool Continuing;
  int Year;
  string Response;
  YearsToRun = GetHowLongToRun();
  if (YearsToRun != 0)
  {
    InitialiseField(ref Field);
    if (YearsToRun >= 1)
    {
      for (Year = 1; Year <= YearsToRun + 1; Year++)
      {
        SimulateOneYear(Field, Year);
      }
    }
    else
    {
      Continuing = true;
      Year = 0;
      while (Continuing)
      {
        Year++;
        SimulateOneYear(Field, Year);
        Console.Write("Press Enter to run simulation for
another Year, Input X to stop: ");
        Response = Console.ReadLine();
        if (Response == "x" || Response == "X")
        {
          Continuing = false;
```

```
        }
      }
    }
    Console.WriteLine("End of Simulation");
    SaveToFile(Field);
  }
  Console.ReadLine();
}
```

11 **1**

```
static void SimulateAutumn(char[,] Field)
{
  string[] Direction = new string[] {"None", "East", "West",
"North",
"South","Southeast","Northeast","Southwest","Northwest"};
  Random RNDWindDirection = new Random();
  int PrevailingWind = RNDWindDirection.Next(0, 9);
  string WindDirection = Direction[PrevailingWind];
  int ColumnDisplacement = 0, RowDisplacement = 0;
  if (WindDirection == "East")
  {
    ColumnDisplacement = -1;
  }
  else if(WindDirection == "West")
  {
    ColumnDisplacement = 1;
  }
  else if (WindDirection == "North")
  {
    RowDisplacement = 1;
  }
  else if (WindDirection == "South")
  {
    RowDisplacement = -1;
  }
  else if (WindDirection == "Southeast")
  {
    RowDisplacement = -1;
    ColumnDisplacement = -1;
  }
  else if (WindDirection == "Northeast")
  {
    RowDisplacement = 1;
    ColumnDisplacement = -1;
  }
  else if (WindDirection == "Southwest")
  {
    RowDisplacement = -1;
    ColumnDisplacement = 1;
  }
  else if (WindDirection == "Northwest")
  {
    RowDisplacement = 1;
    ColumnDisplacement = 1;
```

12

```
  }
  if (WindDirection == "None")
  {
    Console.WriteLine("There was no wind this season");
  }
  else
  {
    Console.WriteLine("Prevailing wind: " + WindDirection );
  }

  for (int Row = 0; Row < FIELDLENGTH; Row++)
  {
    for (int Column = 0; Column < FIELDWIDTH; Column++)
    {
      if (Field[Row, Column] == PLANT)
      {
        SeedLands(Field, Row - 1 + RowDisplacement , Column -
1 + ColumnDisplacement);
        SeedLands(Field, Row - 1 + RowDisplacement, Column +
ColumnDisplacement);
        SeedLands(Field, Row - 1 + RowDisplacement, Column +
1 + ColumnDisplacement);
        SeedLands(Field, Row + RowDisplacement, Column - 1 +
ColumnDisplacement);
        SeedLands(Field, Row + RowDisplacement, Column + 1 +
ColumnDisplacement);
        SeedLands(Field, Row + 1 + RowDisplacement, Column -
1 + ColumnDisplacement);
        SeedLands(Field, Row + 1 + RowDisplacement, Column +
ColumnDisplacement);
        SeedLands(Field, Row + 1 + RowDisplacement, Column +
1 + ColumnDisplacement);
      }
    }
  }
}
```

Java

03	**1**	`public static void main(String[] args)`
		`{`
		`  int Number1 = 0;`
		`  int Number2 = 0;`
		`  int Temp1 = 0;`
		`  int Temp2 = 0;`
		`  int Result = 0;`
		`  Number1 = Console.readInteger("Enter a whole number: ");`
		`  Number2 = Console.readInteger("Enter another whole number: ");`
		`  Temp1 = Number1;`
		`  Temp2 = Number2;`
		`  while (Temp1 != Temp2)`
		`  {`
		`  if (Temp1 > Temp2)`
		`  {`
		`  Temp1 = Temp1 - Temp2;`
		`  }`
		`  else`
		`  {`
		`  Temp2 = Temp2 - Temp1;`
		`  }`
		`  }`
		`  Result = Temp1;`
		`  Console.println(Result + " is GCF of " + Number1 + " and " + Number2 );`
		`}`
			6

08	**1**	`static int GetHowLongToRun()`
		`{`
		`  int Years = 0;`
		`  **boolean Valid = false;**`
		`  Console.println("Welcome to the Plant Growing Simulation");`
		`  Console.println();`
		`  Console.println("You can step through the simulation a year at a time");`
		`  Console.println("or run the simulation for 0 to 5 years");`
		`  Console.println("How many years do you want the simulation to run?");`
		`  **while(!Valid)**`
		`  **{**`
		`  **try**`
		`  **{**`
		`  Years = Console.readInteger("Enter a number between 0 and 5, or -1 for stepping mode: ");`
		`  **if(Years >= -1 && Years <=5)**`
		`  **{**`
		`  **Valid = true;**`
		`  **}**`
		` **}**
			5

		catch(Exception e) **{** **}** **if (!Valid)** **{** **Console.println("Invalid input");** **}** **}** return Years; }	

09	**1**	static void CountPlants(char[][] Field)
		{
		int NumberOfPlants = 0;
		int TotalCells = 0;
		double Percentage = 0;
		for (int Row = 0; Row < FIELDLENGTH; Row++)
		{
		for (int Column = 0; Column < FIELDWIDTH; Column++)
		{
		if (Field[Row][Column] == PLANT)
		{
		NumberOfPlants++;
		}
		}
		}
		if (NumberOfPlants == 1)
		{
		Console.println("There is 1 plant growing");
		}
		else
		{
		Console.println("There are " + NumberOfPlants + " plants growing");
		}
		TotalCells = FIELDLENGTH * FIELDWIDTH;
		Percentage = ((double)NumberOfPlants/(double)TotalCells)*100.0;
		Console.writeLine(Math.round(Percentage) + "%");
		}
			2

10	**1**	**private static void SaveToFile(char[][] Field)** **{** **String Response = "";** **String FileName = "";** **Console.print("Save the current Field state to a text file? (Y/N):");** **Response = Console.readLine();** **if (Response.equals("Y"))** **{** **Console.print("Enter the File Name ");** **FileName = Console.readLine();** **AQAWriteTextFile2017 CurrentFile = new**	**9**

```
AQAWriteTextFile2017(FileName);
    for (int Row = 0; Row < FIELDLENGTH; Row++)
    {
      for (int Column = 0; Column < FIELDWIDTH; Column++)
      {
        CurrentFile.write(Field[Row][Column]);
      }
      CurrentFile.writeLine("|" + String.format("%3d", Row));
    }
    CurrentFile.closeFile();
  }
}


private static void Simulation()
{
  int YearsToRun;
  char[][] Field = new char[FIELDLENGTH][FIELDWIDTH];
  Boolean Continuing;
  int Year;
  String Response;
  YearsToRun = GetHowLongToRun();
  if (YearsToRun != 0)
  {
    InitialiseField(Field);
    if (YearsToRun >= 1)
    {
      for (Year = 1; Year <= YearsToRun; Year++)
      {
        SimulateOneYear(Field, Year);
      }
    }
    else
    {
      Continuing = true;
      Year = 0;
      while (Continuing)
      {
        Year++;
        SimulateOneYear(Field, Year);
        Console.print("Press Enter to run simulation for
another Year, Input X to stop: ");
        Response = Console.readLine();
        if (Response.equals("x") || Response.equals("X"))
        {
          Continuing = false;
        }
      }
    }
    Console.println("End of Simulation");
    SaveToFile(Field);
```

```
  }
  Console.readLine();
}
```

11 **1**

```
static void SimulateAutumn(char[][] Field)
{
  String[] Direction = new String[] {"None", "East", "West",
"North", "South", "Southeast", "Northeast", "Southwest",
"Northwest"};
  Random RNDWindDirection = new Random();
  int PrevailingWind = RNDWindDirection.nextInt(9);
  String WindDirection = Direction[PrevailingWind];
  int ColumnDisplacement  = 0;
  int RowDisplacement = 0;
  if(WindDirection.equals("East"))
  {
    ColumnDisplacement = -1;
  }
  else if(WindDirection.equals("West"))
  {
    ColumnDisplacement = 1;
  }
  else if(WindDirection.equals("North"))
  {
    RowDisplacement = 1;
  }
  else if(WindDirection.equals("South"))
  {
    RowDisplacement = -1;
  }
  else if(WindDirection.equals("Southeast"))
  {
    ColumnDisplacement = -1;
    RowDisplacement = -1;
  }
  else if(WindDirection.equals("Northeast"))
  {
    ColumnDisplacement = -1;
    RowDisplacement = 1;
  }
  else if(WindDirection.equals("Southwest"))
  {
    ColumnDisplacement = 1;
    RowDisplacement = -1;
  }
  else if(WindDirection.equals("Northwest"))
  {
    ColumnDisplacement = 1;
    RowDisplacement = 1;
  }
  if(WindDirection.equals("None"))
  {
```

12

```
    Console.println("There was no wind this season");
  }
  else
  {
    Console.println("Prevailing wind: " + WindDirection);
  }
  for (int Row = 0; Row < FIELDLENGTH; Row++)
  {
    for (int Column = 0; Column < FIELDWIDTH; Column++)
    {
      if (Field[Row][Column] == PLANT)
      {
        SeedLands(Field, Row - 1 + RowDisplacement, Column -
1 + ColumnDisplacement);
        SeedLands(Field, Row - 1 + RowDisplacement, Column +
ColumnDisplacement);
        SeedLands(Field, Row - 1 + RowDisplacement, Column +
1 + ColumnDisplacement);
        SeedLands(Field, Row + RowDisplacement, Column - 1 +
ColumnDisplacement);
        SeedLands(Field, Row + RowDisplacement, Column + 1 +
ColumnDisplacement);
        SeedLands(Field, Row + 1 + RowDisplacement, Column -
1 + ColumnDisplacement);
        SeedLands(Field, Row + 1 + RowDisplacement, Column +
ColumnDisplacement);
        SeedLands(Field, Row + 1 + RowDisplacement, Column +
1 + ColumnDisplacement);
      }
    }
  }
}
```