AS
COMPUTER SCIENCE
7516/1

Paper 1

Mark scheme

June 2025

Version: 1.0 Final

256A7516/1/MS

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 Examiner.

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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

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, D and E

June 2025

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.

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 candidate's responses to the most appropriate level according to **its overall quality**, and 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 **16.1**, the marks available for the AO3 elements are as follows:

AO3 (design)	2 marks
AO3 (programming)	8 marks

In question **17.1**, 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.

Section A

Qu		Marks	
01		**3 marks for AO2 (application)** | M	i	Symbol	Current	Output
---	---	---	---	---
"1001"			0	
	0	1	20	
	1	0	14	
	2	0	4	
	3	1	24	X
					  1 mark for each correct set of values in the correct sequence (boxed in red) **I.** presence/absence of quotation marks around values in all columns and case in `Output` column **Max 2** if any errors	**3**

02		**2 marks for AO1 (understanding)** (Code within) WHILE/Figure 3 loop structure is not executed // final value of X remains the same; (Code within) REPEAT/Figure 4 loop structure will be executed (once) // the value of X changes/decreases; The WHILE loop tests the condition at the start of the loop whereas the REPEAT loop tests the condition at the end of the loop; **Max 2**	**2**

03	**1**	**8 marks for AO3 (programming)** **Mark as follows:** 1. Correct variable declarations for `S`, `Max`, `Matched`, `i`, `Letter1`, `Letter2`; **I.** case **Note to examiners:** If a language allows variables to be used without explicit declaration, (eg Python), then this mark should be awarded if the correct variables exist in the program code and the first value they are assigned is of the correct data type. 2. Correct `WHILE` loop syntax allowed by the programming language and correct condition; 3. Correct prompt "`Enter a word or phrase: `" and `S` assigned value entered by user; **I.** case 4. Correct calculation of `Max`; 5. `FOR` loop iterates correct number of times; 6. Correct `IF THEN` statement syntax allowed by the programming language and correct condition within `FOR` loop; **R**. if inappropriate values for `Letter1` or `Letter2` 7. Correct assignment to `Matched` in `THEN` part; 8. Correct `IF THEN ELSE` statement syntax allowed by the programming language and correct condition after FOR loop and correct output; **I**. case, spelling, spacing **Max 7** if code does not function correctly	**8**

03	**2**	**Mark is for AO3 (evaluate)**
		
		****** SCREEN CAPTURE ******
		Must match code from **03.1**.
		Code for **03.1** must be sensible.
		
		Screen capture showing:
		
		`Enter a word or phrase: madam`
		`Palindrome`
		`Enter a word or phrase: maam`
		`Palindrome`
		`Enter a word or phrase: adam`
		`Not a palindrome`
		`Enter a word or phrase: aam`
		`Not a palindrome`
		`Enter a word or phrase: x`
		`Palindrome`
			1

03	**3**	**Mark is for AO3 (evaluate)** Algorithm makes unnecessary comparisons // by example: eg first and last letters compared twice; The loop continues to iterate after it has been identified that a word is not a palindrome; The loop continues to iterate after `Matched` has been set to `False`; **Max 1**	**1**

04	**1**	**Mark is for AO1 (knowledge)** A named/callable (out of line) block of code (that may be executed by writing the name in a program statement);	**1**
04	**2**	**3 marks for AO1 (understanding)** Easier to re-use code; Easier to understand; Easier to debug/update/maintain/test; Easier to develop a solution // supports structured approach; Less code // faster to develop a solution; Facilitates multiple programmers working on a program simultaneously; Reduces/eliminates side-effects; **A**. enables use of local variables, which only use memory when subroutine is executing **Max 3**	**3**
04	**3**	**2 marks for AO1 (understanding)** Avoids the use of global variables // makes subroutines self-contained/encapsulated; Makes it easier to use the subroutine with different values/expressions/variables; Makes it easier to reuse the subroutine in a different program; Makes it easier to test the subroutine independently of the rest of the program; Makes it clearer which values from outside the subroutine are being used inside the subroutine (as they are explicitly listed); **Max 2**	**2**

05		**Mark is for AO1 (understanding)** (The detail of) how the data are (actually) represented is hidden; New kinds of data objects/structures can be constructed from previously defined types (of data objects); By example (eg stack/queue/tree implemented as an array); **Max 1**	**1**

Section B

Qu		Marks	
06		**Mark is for AO2 (analyse)** `Found/ObstacleFound/ValidDirection/ValidDistance /ObstacleInPath`; **A.** `TreasureFound` **R.** if any additional code **R.** if spelt incorrectly **I.** case and spacing	**1**

07		**Mark is for AO2 (analyse)** `FindLandingPlace`; **R.** if any additional code **R.** if spelt incorrectly **I.** case and spacing	**1**

08	**1**	**Mark is for AO2 (analyse)** `CheckDistance`; **R.** if any additional code **R.** if spelt incorrectly **I.** case and spacing	**1**
08	**2**	**2 marks for AO2 (analyse)** The string/character supplied may not be (convertible to) an integer; Without exception handling the program would crash;	**2**

09	**1**	**Mark is for AO2 (analyse)** `Pirate`; **A**. `PirateRecord` **Java only**: `MoveCheckRecord;` **R.** if any additional code **R.** if spelt incorrectly **I.** case and spacing	**1**
09	**2**	**Mark is for AO2 (analyse)** `Map`/`HiddenMap`/`MapSize`; **A**. `MapSizeRecord` **R.** if any additional code **R.** if spelt incorrectly **I.** case and spacing	**1**

10	**1**	**Mark is for AO1 (knowledge)** Subroutine/procedure/function/method; **A**. module/block of code	**1**
10	**2**	**Mark is for AO2 (analyse)** `PirateWalks/PirateDigs`; **I.** case and spacing	**1**
10	**3**	**Mark is for AO2 (analyse)** `PirateDigs/PirateWalks`; **R**. if given in **10.2** **I.** case and spacing	**1**
10	**4**	**Mark is for AO1 (understanding)** (During the) design (stage); **R**. more than one stage given	**1**

11		**2 marks for AO2 (analyse)** Without this test the `X` would be overwritten / replaced by sand; … after the pirate's/player's (first) move; **A.** … at the beginning of the game **Max 2**	**2**

12		**3 marks for AO2 (analyse)** *Similarity* **(Max 1)**: Both loops count up; Both loops have a step of one; Both loops use `Column`; *Differences* **(Max 2)***:* The loop for `"E"` starts at the start column whereas the loop for `"W"` starts at the end column; The loop for `"E"` ends at the end column whereas the loop for `"W"` ends at the start column; The start and end values for the loops are reversed (between `E` and `W`); **I**. Exact start/end points as long as reference is made to the start and end columns	**3**

13		**3 marks for AO2 (analyse)** `Direction`/`NumberOfSquares`/distance might be valid (independently); But the combination of these …; … could result in `Row` and/or `Column` to be outside the boundaries of the map; (`CheckPath`) would attempt to address elements beyond the bounds of the (`Map`) data structure // would then malfunction/crash; **Max 3**	**3**

14	**1**	**2 marks for AO2 (analyse)** User presses Enter (without entering any other value first) when asked for pirate action; The pirate finds the treasure;	**2**
14	**2**	**Mark is for AO2 (analyse)** Finding a coconut/treasure;	**1**
14	**3**	**Mark is for AO2 (analyse)** Pirate walking/digging;	**1**

Section C

<table>
<tr><th colspan="2">Qu</th><th>Marks</th><th></th></tr>
<tr><td>15</td><td>1</td><td>4 marks for AO3 (programming)

Marking guidance:

Evidence of AO3 programming – 4 marks:

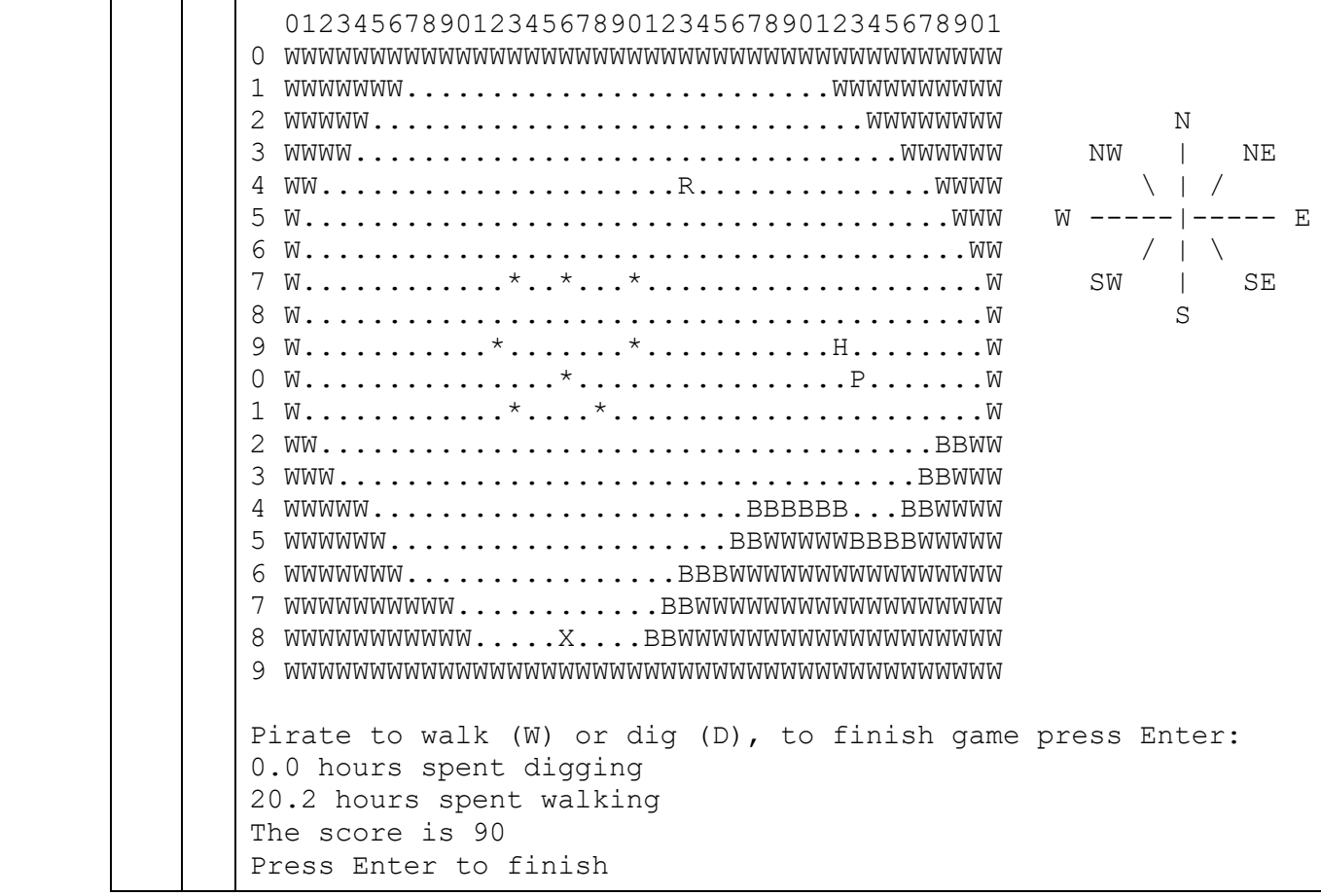
Evidence of programming to look for in response:

1. Field initialised in <code>ResetPirateRecord</code>;
2. Selection structure to detect all eight compass points;
3. Correct calculation of hours walked for all eight directions;
4. In <code>DisplayResults</code> output number of hours walked with suitable message;

Max 3 if any errors</td><td>4</td></tr>
<tr><td>15</td><td>2</td><td>Mark is for AO3 (evaluate)

**** SCREEN CAPTURE ****
Must match code from 15.1, including prompts on screen capture matching those in code.
Code for 15.1 must be sensible.

Screen capture showing:

Pirate to walk (W) or dig (D), to finish game press Enter:
0.0 hours spent digging
20.2 hours spent walking
The score is 90
Press Enter to finish</td><td>1</td></tr>
</table>

16	**1**	**2 marks for AO3 (design) and 8 marks for AO3 (programming)** **Marking guidance:** **Evidence of AO3 design – 2 marks**: Evidence of design to look for in response: 1. Identify the need to ask for row and column; 2. Identify the need to test for sand or water to check for a beach; **Note: AO3** (design) points 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 and regardless of whether the solution works. **Evidence of AO3 programming – 8 marks**: Evidence of programming to look for in response: 3. Ask for user input whether different landing place required; 4. Correctly assign user input to entered row and column variables; 5. Check that the entered row and column represent sand; 6. Correctly check that entered position is next to water; 7. **only if** on sand and next to water … 8. … Set pirate position to entered position; 9. … and put pirate on map and display map; 10. … otherwise output a suitable message; **Max 9** if any errors	**10**

16	**2**	**Mark is for AO3 (evaluate)** ****** SCREEN CAPTURE ****** Must match code from **16.1**, including prompts on screen capture matching those in code. Code for **16.1** must be sensible. X marks the spot where the pirate comes ashore Do you want the pirate to land elsewhere? (Y/N): Y Which row is the pirate coming ashore? 6 Which column is the pirate coming ashore? 1 0123456789012345678901234567890123456789012345678901 0 WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW 1 WWWWWWW.....WWWWWWWWWW 2 WWWWW.....WWWWWWWWW 3 WWWW.....WWWWWW 4 WW.....R.....WWWW 5 W.....WWW 6 WP.....WW 7 W.....*..*...*.....W 8 W.....W 9 W.....*.....*.....H.....W 0 W.....*.....W 1 W.....*....*.....W 2 WW.....BBWW 3 WWW.....BBWWW 4 WWWWW.....BBBBBB...BBWWWW 5 WWWWWW.....BBWWWWWBBBBWWWWW 6 WWWWWWW.....BBBWWWWWWWWWWWWWWW 7 WWWWWWWWWW.....BBWWWWWWWWWWWWWWWWW 8 WWWWWWWWWWW.....X....BBWWWWWWWWWWWWWWWWWWW 9 WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW N NW | NE \ | / W -----|----- E / | \ SW | SE S	**1**

16	**3**	**Mark is for AO3 (evaluate)** ****** SCREEN CAPTURE ****** Must match code from **16.1**, including prompts on screen capture matching those in code. Code for **16.1** must be sensible.	**1**

```
X marks the spot where the pirate comes ashore

Do you want the pirate to land elsewhere? (Y/N): Y
Which row is the pirate coming ashore? 17
Which column is the pirate coming ashore? 21
That was not a good landing place, so the pirate lands at X
Pirate to walk (W) or dig (D), to finish game press Enter: W
Enter length (between 1 and 9) and direction (N, NE, E, SE, S,
SW, W, NW): 1N

  012345678901234567890123456789012345678901
0 WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW
1 WWWWWWWW.........................WWWWWWWWWW
2 WWWWW.............................WWWWWWWW
3 WWWW...............................WWWWWW
4 WW.....................R..............WWWW
5 W.........................................WWW
6 W.........................................WW
7 W............*..*...*.....................W
8 W.........................................W
9 W...........*.......*...........H........W
0 W..............*.........................W
1 W............*....*.......................W
2 WW.....................................BBWW
3 WWW...................................BBWWW
4 WWWWW.....................BBBBBB...BBWWWW
5 WWWWWW..................BBWWWWWBBBBWWWWW
6 WWWWWWW..............BBBWWWWWWWWWWWWWWW
7 WWWWWWWWWW......P.....BBWWWWWWWWWWWWWWWW
8 WWWWWWWWWWW.....X....BBWWWWWWWWWWWWWWWWW
9 WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW
```

```
          N
     NW   |   NE
        \ | /
W -----|----- E
        / | \
     SW   |   SE
          S
```

17 | **1** | **3 marks for AO3 (design) and 9 marks for AO3 (programming)** | **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. All of the appropriate design decisions have been taken.	9–12
2	There is evidence that a line of reasoning has been partially followed. There is evidence of some appropriate design work. This is a partially working programmed solution.	5–8
1	An attempt has been made to amend the subroutine `PirateWalks` or to create one of the other two subroutines. Some appropriate programming statements have been written. There is little 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 subroutines will have very little or none of the extra required functionality. It is unlikely that any of the key design elements of the task have been recognised.	1–4

Marking guidance:

Evidence of AO3 design – 3 marks:

Evidence of design to look for in response:

1. Attempt to test for pirate west of hut as a subroutine.
2. Recognise the need for a nested loop to find the rock/treasure in the hidden map.
3. Attempt to calculate distance of treasure from rock in one direction.

Note: AO3 (design) points 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 and regardless of whether the solution works.

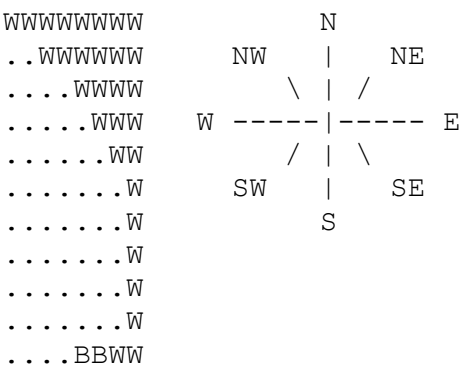
Evidence of AO3 programming – 9 marks:

Evidence of programming to look for in response:

4. Correct parameters and return values for `WestOfHut`.
5. Correct parameters for `GetClue`.
6. Correctly search for rock.
7. Correctly search for treasure.
8. Correctly calculate distance of treasure from rock in NS and EW direction within subroutine `GetClue`
9. Output distance in NS and EW direction within subroutine `GetClue` **DPT** if in wrong subroutine
10. Ensure distances are positive.
11. Call `WestOfHut` in correct place in `PirateWalks`.
12. Call `GetClue` under correct conditions.

Max 11 if code does not function correctly

17	**2**	**Mark is for AO3 (evaluate)**
		
		****** SCREEN CAPTURE ******
		Must match code from **17.1**, including prompts on screen capture matching those in code.
		Code for **17.1** must be sensible.
		
		Screen capture showing:
		
		`  01234567890123456789012345678901`
		`0 WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW`
		`1 WWWWWWW.....WWWWWWWWWW`
		`2 WWWWW.....WWWWWWWWW`
		`3 WWWW.....WWWWWW`
		`4 WW.....R.....WWWW`
		`5 W.....WWW`
		`6 W.....WW`
		`7 W.....*..*...*.....W`
		`8 W.....W`
		`9 W.....*.....*.....PH.....W`
		`0 W.....*.....W`
		`1 W.....*....*.....W`
		`2 WW.....BBWW`
		`3 WWW.....BBWWW`
		`4 WWWWW.....BBBBBB...BBWWWW`
		`5 WWWWWW.....BBWWWWWBBBBWWWWW`
		`6 WWWWWWW.....BBBWWWWWWWWWWWWWW`
		`7 WWWWWWWWWW.....BBWWWWWWWWWWWWWWWW`
		`8 WWWWWWWWWWW.....X....BBWWWWWWWWWWWWWWWWW`
		`9 WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW`
		
		`The treasure is 2 squares away from the rock in the North - South direction`
		`The treasure is 4 squares away from the East - West direction`
			1



VB.Net

03	**1**	`Sub Main()`
		`  Dim S As String = ""`
		`  Dim Letter1, Letter2 As Char`
		`  Dim Max As Integer`
		`  Dim Matched As Boolean  ' MP1`
		`  While S <> "x"  ' MP2`
		`  Console.Write("Enter a word or phrase: ")`
		`  S = Console.ReadLine()  ' MP3`
		`  Max = S.Length - 1  ' MP4`
		`  Matched = True`
		`  For i = 0 To Max  ' MP5`
		`  Letter1 = S(i)`
		`  Letter2 = S(Max - i)`
		`  If Letter1 <> Letter2 Then  ' MP6`
		`  Matched = False  ' MP7`
		`  End If`
		`  Next`
		`  If Matched = True Then`
		`  Console.WriteLine("Palindrome")`
		`  Else`
		`  Console.WriteLine("Not a palindrome")  ' MP8`
		`  End If`
		`  End While`
		`  Console.ReadLine()`
		`End Sub`
			8

15	1		4

```
Sub ResetPirateRecord(ByRef Pirate As PirateRecord)
  Pirate.Row = 0
  Pirate.Column = 0
  Pirate.Score = 100
  Pirate.DigTime = 0.0
  Pirate.TreasureFound = False
  Pirate.NumberOfCoinsFound = 0
  Pirate.WalkTime = 0.0  ' MP1  Task 1
End Sub

Sub PirateWalks(Map(,) As String, MapSize As MapSizeRecord,
HiddenMap(,) As String, ByRef Pirate As PirateRecord)
  Dim ObstacleInPath As Boolean = True
  Dim ValidDistance As Boolean = False
  Dim ValidDirection As Boolean = False
  Dim WalkData, Direction As String
  Dim Row, Column, NumberOfSquares As Integer
  While ObstacleInPath Or Not ValidDistance Or Not ValidDirection
    Console.Write("Enter length (1 to 9) and direction (N, NE, E, SE,
S, SW, W, NW): ")
    WalkData = Console.ReadLine()
    Row = Pirate.Row
    Column = Pirate.Column
    ValidDistance = CheckDistance(WalkData(0), NumberOfSquares)
    Direction = WalkData.Substring(1)
    ValidDirection = CheckDirection(Direction, Row, Column,
NumberOfSquares)
    If Row >= MapSize.Rows Or Column >= MapSize.Columns Or Row < 0 Or
Column < 0 Then
      ValidDirection = False
      Console.WriteLine("Error")
    End If
    If ValidDirection Then
      ObstacleInPath = CheckPath(Map, Pirate.Row, Pirate.Column, Row,
Column, Direction)
      If ObstacleInPath Then
        Console.WriteLine("Pirate can't walk this way as there is an
obstacle in the way")
      End If
    End If
  End While
  Move(Map, MapSize, Pirate, Row, Column)
  If Len(Direction) = 1 Then
    Pirate.WalkTime += NumberOfSquares  ' MP2
  Else
    Pirate.WalkTime += NumberOfSquares * 1.4  ' MP3  Task 2
  End If
End Sub

Sub DisplayResults(Pirate As PirateRecord)
  If Pirate.NumberOfCoinsFound > 0 Then
    Console.WriteLine($"{Pirate.NumberOfCoinsFound} gold coins found")
  End If
  Console.WriteLine($"{Pirate.DigTime:N} hours spent digging")
  Console.WriteLine($"{Pirate.WalkTime:N} hours spent walking")  ' MP4
Task3
  Console.WriteLine($"The score is { Pirate.Score }")
End Sub
```

Alternative answer 1 for mark points 2 and 3:

```
  Move(Map, MapSize, Pirate, Row, Column)
  If "EWNS".Contains(Direction) Then  'Task 2 NB EW or WE needs to be
first
   Pirate.WalkTime += NumberOfSquares  ' MP2
  Else
    Pirate.WalkTime += NumberOfSquares * 1.4  ' MP3  Task 2
  End If
```

Alternative answer 2 for mark points 2 and 3:

```
  Move(Map, MapSize, Pirate, Row, Column)
  If {"N", "S", "E", "W"}.Contains(Direction) Then
    Pirate.WalkTime += NumberOfSquares  ' MP2
  Else
    Pirate.WalkTime += NumberOfSquares * 1.4  ' MP3  Task 2
  End If
```

Alternative answer 3 for mark points 2 and 3:

```
  Move(Map, MapSize, Pirate, Row, Column)
  If Direction = "N" Or Direction = "S" Or Direction = "E" Or Direction
= "W" Then  'Task 2
    Pirate.WalkTime += NumberOfSquares  ' MP2
  Else
    Pirate.WalkTime += NumberOfSquares * 1.4  ' MP3  Task 2
  End If
```

16	**1**	See code below	**10**

```
Sub FindLandingPlace(Map(,) As String, MapSize As MapSizeRecord, ByRef
Pirate As PirateRecord)
  Dim Found As Boolean = False
  Dim Row, Column As Integer
  Row = 0
  While Not Found And Row < MapSize.Rows
    Column = 0
    While Not Found And Column < MapSize.Columns
      If Map(Row, Column) = "X" Then
        Found = True
        Pirate.Row = Row
        Pirate.Column = Column
      End If
      Column += 1
    End While
    Row += 1
  End While
  DisplayMap(Map, MapSize)
  Console.WriteLine("X marks the spot where the pirate comes ashore")
  Console.WriteLine()
  Console.Write("Do you want the pirate to land elsewhere? (Y/N) ")
  Dim Reply As String = Console.ReadLine().ToUpper  ' MP3
  If Reply = "Y" Then
    Console.Write("Which row is the pirate coming ashore? ")
    Row = Convert.ToInt32(Console.ReadLine())
    Console.Write("Which column is the pirate coming ashore? ")  ' MP1
    Column = Convert.ToInt32 (Console.ReadLine())  ' MP4
    If Map(Row, Column) = SAND And (Map(Row + 1, Column) = WATER Or
Map(Row - 1, Column) = WATER Or Map(Row, Column + 1) = WATER Or
Map(Row, Column - 1) = WATER) Then  ' MP2  MP5  MP6  MP7
      Pirate.Row = Row
      Pirate.Column = Column  ' MP8
      Map(Row, Column) = PIRATES
      DisplayMap(Map, MapSize)  ' MP9
    Else
      Console.WriteLine("That was not a good landing place, so the
priate lands at X")  ' MP10
    End If
  End If
End Sub
```

17	1		12

```
Function WestOfHut(Map(,) As String, Pirate As PirateRecord) As Boolean
  If Map(Pirate.Row, Pirate.Column + 1) = HUT Then  ' MP1  Task 1
    Return True
  Else
    Return False  ' MP4
  End If
End Function

Sub GetClue(Map(,) As String, MapSize As MapSizeRecord, HiddenMap(,) As
String)  ' MP5 Task 2
  Dim RockRow, RockColumn, TreasureRow, TreasureColumn as Integer
  Dim NSDistance, EWDistance As Integer
  For Row = 0 To MapSize.Rows - 1
    For Column = 0 To MapSize.Columns - 1  ' MP2
      If Map(Row, Column) = ROCK Then  ' MP6
        RockRow = Row
        RockColumn = Column
      End If
      If HiddenMap(Row, Column) = TREASURE Then  ' MP7
        TreasureRow = Row
        TreasureColumn = Column
      End If
    Next
  Next
  NSDistance = Math.Abs(RockRow - TreasureRow)  ' MP3
  EWDistance = Math.Abs(RockColumn - TreasureColumn)  ' MP8  MP10
  Console.WriteLine($"The treasure is {NSDistance} squares way from the
rock in the North - South direction")
  Console.WriteLine($" The treasure is {EWDistance} squares away from
the rock in the East - West direction")  ' MP9
End Sub

Sub PirateWalks(Map(,) As String, MapSize As MapSizeRecord,
HiddenMap(,) As String, ByRef Pirate As PirateRecord)
  Dim ObstacleInPath As Boolean = True
  Dim ValidDistance As Boolean = False
  Dim ValidDirection As Boolean = False
  Dim WalkData, Direction As String
  Dim Row, Column, NumberOfSquares As Integer
  While ObstacleInPath Or Not ValidDistance Or Not ValidDirection
    Console.Write("Enter length (1 to 9) and direction (N, NE, E, SE,
S, SW, W, NW): ")
    WalkData = Console.ReadLine()
    Row = Pirate.Row
    Column = Pirate.Column
    ValidDistance = CheckDistance(WalkData(0), NumberOfSquares)
    Direction = WalkData.Substring(1)
    ValidDirection = CheckDirection(Direction, Row, Column,
NumberOfSquares)
    If Row >= MapSize.Rows Or Column >= MapSize.Columns Or Row < 0 Or
Column < 0 Then
      ValidDirection = False
      Console.WriteLine("Error")
    End If
    If ValidDirection Then
      ObstacleInPath = CheckPath(Map, Pirate.Row, Pirate.Column, Row,
Column, Direction)
      If ObstacleInPath Then
        Console.WriteLine("Pirate can't walk this way as there is an
obstacle in the way")
      End If
```

```
    End If
  End While
  Move(Map, MapSize, Pirate, Row, Column)
...
  If WestOfHut(Map, Pirate) Then  ' MP11 Task 3
    GetClue(Map, MapSize, HiddenMap)  ' MP12
  End If
End Sub
```

Python 3

03	**1**	`S = ""`
		`while S != "x":  # MP1  # MP2`
		`  S = input("Enter a word or phrase: ")  # MP3`
		`  Max = len(S) - 1  # MP4`
		`  Matched = True`
		`  for i in range(Max + 1):  # MP5`
		`  Letter1 = S[i]`
		`  Letter2 = S[Max - i]`
		`  if Letter1 != Letter2:  # MP6`
		`  Matched = False  # MP7`
		`  if Matched:`
		`  print("Palindrome")`
		`  else:`
		`  print("Not a palindrome")  # MP8`
			8

15 **1** **4**

```
def ResetPirateRecord(Pirate):
  Pirate.Row = 0
  Pirate.Column = 0
  Pirate.Score = 100
  Pirate.DigTime = 0.0
  Pirate.TreasureFound = False
  Pirate.NumberOfCoinsFound = 0
  Pirate.WalkTime = 0.0  # MP1  Task 1

def PirateWalks(Map, MapSize, HiddenMap, Pirate):
  ObstacleInPath = True
  ValidDistance = False
  ValidDirection = False
  while ObstacleInPath or not ValidDistance or not ValidDirection:
    WalkData = input("Enter length (1 to 9) and direction (N, NE, E, SE, S,
SW, W, NW): ")
    Row = Pirate.Row
    Column = Pirate.Column
    ValidDistance, NumberOfSquares = CheckDistance(WalkData[0])
    Direction = WalkData[1:]
    ValidDirection, Row, Column = CheckDirection(Direction, Row, Column,
NumberOfSquares)
    if Row >= MapSize.Rows or Column >= MapSize.Columns or Row < 0 or Column
< 0:
      ValidDirection = False
      print("Error")
    if ValidDirection:
      ObstacleInPath = CheckPath(Map, Pirate.Row, Pirate.Column, Row,
Column, Direction)
      if ObstacleInPath:
        print("Pirate can't walk this way as there is an obstacle in the
way")
  Move(Map, MapSize, Pirate, Row, Column)
  if len(Direction) == 1:                    # Task 2
    Pirate.WalkTime += NumberOfSquares       # MP2
  else:                                      #
    Pirate.WalkTime += 1.4 * NumberOfSquares  # MP3

def DisplayResults(Pirate):
  if Pirate.NumberOfCoinsFound > 0:
    print(f"{Pirate.NumberOfCoinsFound} gold coins found")
  print(f"{Pirate.DigTime} hours spent digging")
  print(f"{Pirate.WalkTime} hours spent walking")  # MP4  Task 3
  print(f"The score is {Pirate.Score}")
```

Alternative answer 1 for mark points 2 and 3:

```
  Move(Map, MapSize, Pirate, Row, Column)
  if Direction in "WESN":                    # Task 2
    Pirate.WalkTime += NumberOfSquares       # MP2
  else:                                      #
    Pirate.WalkTime += 1.4 * NumberOfSquares  # MP3
```

Alternative answer 2 for mark points 2 and 3:

```
  Move(Map, MapSize, Pirate, Row, Column)
  if Direction in ["N", "S", "E", "W"]:      # Task 2
    Pirate.WalkTime += NumberOfSquares       # MP2
  else:                                      #
    Pirate.WalkTime += 1.4 * NumberOfSquares  # MP3
```

		Alternative answer 3 for mark points 2 and 3:
		
		`Move(Map, MapSize, Pirate, Row, Column)`
		`if Direction == "N" or Direction == "S" or Direction == "E" or Direction == "W":  # Task 2`
		`  Pirate.WalkTime += NumberOfSquares  # MP2`
		`else:  #`
		`  Pirate.WalkTime += 1.4 * NumberOfSquares  # MP3`	

16	**1**	`def FindLandingPlace(Map, MapSize, Pirate):`
		`  Found = False`
		`  Row = 0`
		`  while not Found and Row < MapSize.Rows:`
		`  Column = 0`
		`  while not Found and Column < MapSize.Columns:`
		`  if Map[Row][Column] == 'X':`
		`  Found = True`
		`  Pirate.Row = Row`
		`  Pirate.Column = Column`
		`  Column += 1`
		`  Row += 1`
		`  DisplayMap(Map, MapSize)`
		`  print("X marks the spot where the pirate comes ashore")`
		`  print()`
		`  Answer = input("Do you want the pirate to land elsewhere? (Y/N): ")  # MP3`
		`  if Answer == "Y":`
		`  Row = 0`
		`  Column = 0`
		`  Row = int(input("Which row is the pirate coming ashore? "))  # MP1`
		`  Column = int(input("Which column is the pirate coming ashore? "))  # MP4`
		`  OnSand = False`
		`  NextToWater = False`
		`  if Map[Row][Column] == SAND:  # MP5`
		`  OnSand = True`
		`  if Map[Row - 1][Column] == WATER or Map[Row + 1][Column] == WATER:  # MP2`
		`  NextToWater = True`
		`  if Map[Row][Column + 1] == WATER or Map[Row][Column - 1] == WATER:  # MP6`
		`  NextToWater = True`
		`  if OnSand and NextToWater:  # MP7`
		`  Pirate.Row = Row  #`
		`  Pirate.Column = Column  # MP8`
		`  Map[Row][Column] = PIRATES`
		`  DisplayMap(Map, MapSize)  # MP9`
		`  else:`
		`  print("That was not a good landing place, so the pirate lands at X")  # MP10`
			10

17	1	**def WestOfHut(Map, Pirate):**
		** if Map[Pirate.Row][Pirate.Column + 1] == HUT: # MP1 Task 1**
		** return True #**
		** else: #**
		** return False # MP4**
		
		def GetClue(Map, MapSize, HiddenMap): # MP5 Task 2
		** for Row in range(MapSize.Rows):**
		** for Column in range(MapSize.Columns): # MP2**
		** if Map[Row][Column] == ROCK: # MP6**
		** RockRow = Row**
		** RockColumn = Column**
		** for Row in range(MapSize.Rows):**
		** for Column in range(MapSize.Columns):**
		** if HiddenMap[Row][Column] == TREASURE: # MP7**
		** TreasureRow = Row**
		** TreasureColumn = Column**
		** DistanceFromRock_NS = TreasureRow - RockRow # MP3**
		** if DistanceFromRock_NS < 0:**
		** DistanceFromRock_NS = - DistanceFromRock_NS**
		** DistanceFromRock_WE = TreasureColumn - RockColumn # MP8**
		** if DistanceFromRock_WE < 0:**
		** DistanceFromRock_WE = - DistanceFromRock_WE # MP10**
		** print(f"The treasure is {DistanceFromRock_NS} squares away from the rock in the North - South direction") #**
		** print(f"The treasure is {DistanceFromRock_WE} squares away from the rock in the East - West direction") # MP9**
		
		def PirateWalks(Map, MapSize, HiddenMap, Pirate):
		  ObstacleInPath = True
		  ValidDistance = False
		  ValidDirection = False
		  while ObstacleInPath or not ValidDistance or not ValidDirection:
		  WalkData = input("Enter length (1 to 9) and direction (N, NE, E, SE, S, SW, W, NW): ")
		  Row = Pirate.Row
		  Column = Pirate.Column
		  ValidDistance, NumberOfSquares = CheckDistance(WalkData[0])
		  Direction = WalkData[1:]
		  ValidDirection, Row, Column = CheckDirection(Direction, Row, Column, NumberOfSquares)
		  if Row >= MapSize.Rows or Column >= MapSize.Columns or Row < 0 or Column < 0:
		  ValidDirection = False
		  print("Error")
		  if ValidDirection:
		  ObstacleInPath = CheckPath(Map, Pirate.Row, Pirate.Column, Row, Column, Direction)
		  if ObstacleInPath:
		  print("Pirate can't walk this way as there is an obstacle in the way")
		  Move(Map, MapSize, Pirate, Row, Column)
		...
		** if WestOfHut(Map, Pirate): # MP11 Task 3**
		** GetClue(Map, MapSize, HiddenMap) # MP12**
			12

C#

03	**1**	`string s = "";`
		`int max = 0;`
		`bool matched = true;`
		`string letter1 = "";`
		`string letter2 = "";  // MP1`
		`while (s != "x")  // MP2`
		`{`
		`  Console.Write("Enter a word or phrase: ");`
		`  s = Console.ReadLine();  // MP3`
		`  max = s.Length - 1;  // MP4`
		`  matched = true;`
		`  for (int i = 0; i <= max; i++)  // MP5`
		`  {`
		`    letter1 = s[i].ToString();`
		`    letter2 = s[max - i].ToString();`
		`    if (letter1 != letter2)  // MP6`
		`    {`
		`      matched = false;  // MP7`
		`    }`
		`  }`
		`  if (matched == true)`
		`  {`
		`    Console.WriteLine("Palindrome");`
		`  }`
		`  else`
		`  {`
		`    Console.WriteLine("Not a Palindrome"); // MP8`
		`  }`
		`}`
			8

15	**1**	public static void ResetPirateRecord(ref PirateRecord pirate)
		{
		pirate.row = 0;
		pirate.column = 0;
		pirate.score = 100;
		pirate.digTime = 0.0;
		pirate.treasureFound = false;
		pirate.numberOfCoinsFound = 0;
		pirate.walkTime = 0.0; // MP1 Task 1
		}
		
		static void PirateWalks(string[,] map, MapSizeRecord mapSize, string[,] hiddenMap, ref PirateRecord pirate)
		{
		bool obstacleInPath;
		bool validDistance;
		bool validDirection;
		string walkData;
		string direction = "";
		int row = 0;
		int column = 0;
		int numberOfSquares = 0;
		obstacleInPath = true;
		validDistance = false;
		validDirection = false;
		while (obstacleInPath || !validDistance || !validDirection)
		{
		Console.Write("Enter length (1 to 9) and direction (N, NE, E, SE, S, SW, W, NW): ");
		walkData = Console.ReadLine();
		row = pirate.row;
		column = pirate.column;
		(validDistance, numberOfSquares) = CheckDistance(walkData[0].ToString());
		direction = walkData.Substring(1);
		(validDirection, row, column) = CheckDirection(direction, row, column, numberOfSquares);
		if (row >= mapSize.rows || column >= mapSize.columns || row < 0 || column < 0)
		{
		validDirection = false;
		Console.WriteLine("Error");
		}
		if (validDirection)
		{
		obstacleInPath = CheckPath(map, pirate.row, pirate.column, row, column, direction);
		if (obstacleInPath)
		{
		Console.WriteLine("Pirate can't walk this way as there is an obstacle in the way");
		}
		}
		}
		Move(map, mapSize, ref pirate, row, column);
		if (direction.Length == 1) // Task 2
			4

```
        {
          pirate.walkTime += numberOfSquares;  // MP2
        }
        else
        {
          pirate.walkTime += 1.4 * numberOfSquares;  // MP3
        }
    }
```

16	**1**	`  public static void FindLandingPlace(string[,] map, MapSizeRecord mapSize, ref PirateRecord pirate)`
		`  {`
		`    bool found = false;`
		`    int row = 0;`
		`    while (!found && (row < mapSize.rows))`
		`    {`
		`      int column = 0;`
		`      while (!found && (column < mapSize.columns))`
		`      {`
		`        if (map[row, column] == "X")`
		`        {`
		`          found = true;`
		`          pirate.row = row;`
		`          pirate.column = column;`
		`        }`
		`        column++;`
		`      }`
		`      row++;`
		`    }`
		`    DisplayMap(map, mapSize);`
		`    Console.WriteLine("X marks the spot where the pirate comes ashore");`
		`    Console.WriteLine();`
		`    **Console.Write("Do you want the pirate to land elsewhere (Y/N) ");**`
		`    **string answer = Console.ReadLine();  // MP3**`
		`    **if (answer == "Y")**`
		`    **{**`
		`      **Console.Write("Which row is the pirate coming ashore? ");**`
		`      **row = Convert.ToInt32(Console.ReadLine());  // MP1**`
		`      **Console.Write("Which column is the pirate coming ashore? ");**`
		`      **int column = Convert.ToInt32(Console.ReadLine()); // MP4**`
		`      **bool onSand = false;**`
		`      **bool nextToWater = false;**`
		`      **if (map[row, column] == SAND) //MP5**`
		`      **{**`
		`        **onSand = true;**`
		`      **}**`
		`      **if (map[row - 1, column] == WATER || map[row + 1, column] == WATER)  // MP2**`
		`      **{**`
		`        **nextToWater = true;**`
		`      **}**`
		`      **if (map[row, column - 1] == WATER || map[row, column + 1] == WATER)  // MP6**`
		`      **{**`
		`        **nextToWater = true;**`
		`      **}**`
		`      **if (onSand && nextToWater)  // MP7**`
		`      **{**`
		`        **pirate.row = row;**`
		`        **pirate.column = column;  // MP8**`
		`        **map[row, column] = PIRATES;**`
		` **DisplayMap(map, mapSize); // MP9**
			10

```
      }
      else
      {
        Console.WriteLine("That was not a good landing place, so
the pirate lands at X");  // MP10
      }
    }
  }
```

17	1	`  private static bool WestOfHut(string[,] map, PirateRecord pirate)`
		`  {`
		`  if (map[pirate.row, pirate.column + 1] == HUT) // MP1 Task 1`
		`  {`
		`  return true;`
		`  }`
		`  return false;  // MP4`
		`  }`
		
		`  private static void GetClue(string[,] map, MapSizeRecord mapSize, string[,] hiddenMap)  // MP5  Task 2`
		`  {`
		`  int rockRow = 0, rockColumn = 0, treasureRow = 0, treasureColumn = 0;`
		`  int distanceFromRockNS = 0, distanceFromRockWE = 0;`
		`  for (int row = 0; row < mapSize.rows; row++)`
		`  {`
		`  for (int column = 0; column < mapSize.columns; column++) // MP2`
		`  {`
		`  if (map[row, column] == ROCK) // MP6`
		`  {`
		`  rockRow = row;`
		`  rockColumn = column;`
		`  }`
		`  }`
		`  }`
		`  for (int row = 0; row < mapSize.rows; row++)`
		`  {`
		`  for (int column = 0; column < mapSize.columns; column++)`
		`  {`
		`  if (hiddenMap[row, column] == TREASURE)  // MP7`
		`  {`
		`  treasureRow = row;`
		`  treasureColumn = column;`
		`  }`
		`  }`
		`  }`
		`  distanceFromRockNS = treasureRow - rockRow;  // MP3`
		`  if (distanceFromRockNS < 0)`
		`  {`
		`  distanceFromRockNS = -distanceFromRockNS;`
		`  }`
		`  distanceFromRockWE = treasureColumn - rockColumn;  // MP8`
		`  if (distanceFromRockWE < 0)`
		`  {`
		`  distanceFromRockWE = -distanceFromRockWE;  // MP10`
		`  }`
		`  Console.WriteLine($"The treasure is {distanceFromRockNS} squares away from the rock in the North - South direction");`
		`  Console.WriteLine($"The treasure is {distanceFromRockWE} squares away from the rock in the East - West direction");  // MP9`
		`  }`
			12

```
  static void PirateWalks(string[,] map, MapSizeRecord mapSize,
string[,] hiddenMap, ref PirateRecord pirate)
  {
    bool obstacleInPath;
    bool validDistance;
    bool validDirection;
    string walkData;
    string direction = "";
    int row = 0;
    int column = 0;
    int numberOfSquares = 0;
    obstacleInPath = true;
    validDistance = false;
    validDirection = false;
    while (obstacleInPath || !validDistance || !validDirection)
    {
      Console.Write("Enter length (1 to 9) and direction (N, NE,
E, SE, S, SW, W, NW): ");
      walkData = Console.ReadLine();
      row = pirate.row;
      column = pirate.column;
      (validDistance, numberOfSquares) =
CheckDistance(walkData[0].ToString());
      direction = walkData.Substring(1);
      (validDirection, row, column) = CheckDirection(direction,
row, column, numberOfSquares);
      if (row >= mapSize.rows || column >= mapSize.columns ||
row < 0 || column < 0)
      {
        validDirection = false;
        Console.WriteLine("Error");
      }
      if (validDirection)
      {
        obstacleInPath = CheckPath(map, pirate.row,
pirate.column, row, column, direction);
        if (obstacleInPath)
        {
          Console.WriteLine("Pirate can't walk this way as there
is an obstacle in the way");
        }
      }
    }
    Move(map, mapSize, ref pirate, row, column);
    if (WestOfHut(map, pirate))  // MP11 Task 3
    {
      GetClue(map, mapSize, hiddenMap);  // MP12
    }
  }
```

Java

03	**1**	`String S = "";`
		`while (!S.equals("x")) {  // MP2`
		`  Console.write("Enter a word or phrase: ");`
		`  S = Console.readLine();  // MP3`
		`  int Max = S.length() - 1;  // MP4`
		`  boolean Matched = true;`
		`  for (int i=0; i<Max+1; i++) {  // MP5`
		`    char Letter1 = S.charAt(i);`
		`    char Letter2 = S.charAt(Max - i);  // MP1`
		`      if (Letter1 != Letter2) {  // MP6`
		`        Matched = false;  // MP7`
		`      }`
		`  }`
		`  if (Matched) {`
		`    Console.println("Palindrome");`
		`  } else {`
		`    Console.println("Not a palindrome");  // MP8`
		`  }`
		`}`
			8

15 **1**

```
  void ResetPirateRecord(PirateRecord Pirate) {
    Pirate.Row = 0;
    Pirate.Column = 0;
    Pirate.Score = 100;
    Pirate.DigTime = 0.0f;
    Pirate.TreasureFound = false;
    Pirate.NumberOfCoinsFound = 0;
    Pirate.WalkTime = 0.0f;  // MP1 Task 1
  }

  void PirateWalks(String[][] Map, MapSizeRecord MapSize, String[][]
HiddenMap, PirateRecord Pirate) {
    boolean ObstacleInPath = true;
    boolean ValidDistance = false;
    boolean ValidDirection = false;
    int Row = 0, Column = 0, NumberOfSquares = 0;
    String Direction = "";
    while (ObstacleInPath || !ValidDistance || !ValidDirection) {
      Console.write("Enter length (1 to 9) and direction (N, NE, E, SE, S,
SW, W, NW): ");
      String WalkData = Console.readLine();
      Row = Pirate.Row;
      Column = Pirate.Column;
      MoveCheckRecord DistanceData =
CheckDistance(String.valueOf(WalkData.charAt(0)));
      ValidDistance = DistanceData.valid;
      NumberOfSquares = DistanceData.numberOfSquares;
      Direction = WalkData.substring(1);
      MoveCheckRecord DirectionData = CheckDirection(Direction, Row, Column,
NumberOfSquares);
      ValidDirection = DirectionData.valid;
      Row = DirectionData.row;
      Column = DirectionData.column;
      if (Row >= MapSize.Rows || Column >= MapSize.Columns || Row < 0 ||
Column < 0) {
        ValidDirection = false;
        Console.writeLine("Error");
      }
      if (ValidDirection) {
        ObstacleInPath = CheckPath(Map, Pirate.Row, Pirate.Column, Row,
Column, Direction);
        if (ObstacleInPath) {
          Console.writeLine("Pirate can't walk this way as there is an
obstacle in the way");
        }
      }
    }
    Move(Map, MapSize, Pirate, Row, Column);
    if (Direction.length() == 1) {
      Pirate.WalkTime += NumberOfSquares;  // MP2 Task 2
    } else {
      Pirate.WalkTime += 1.4 * NumberOfSquares;  // MP3 Task 2
    }
  }

  void DisplayResults(PirateRecord Pirate) {
    if (Pirate.NumberOfCoinsFound > 0) {
      Console.writeLine(Pirate.NumberOfCoinsFound + " gold coins found");
    }
    Console.writeLine(Pirate.DigTime + " hours spent digging");
```

```
    Console.writeLine(Pirate.WalkTime + " hours spent walking");  // MP4
Task3
    Console.writeLine("The score is " + Pirate.Score);
  }
```

Alternative answer 1 for mark points 2 and 3:

```
if ("NSEW".contains(Direction)) {
  Pirate.WalkTime += NumberOfSquares;
} else {
  Pirate.WalkTime += 1.4 * NumberOfSquares;
}
```

Alternative answer 2 for mark points 2 and 3:

```
if (Direction == "N" || Direction == "S" || Direction == "E" || Direction ==
"W") {
  Pirate.WalkTime += NumberOfSquares;
} else {
  Pirate.WalkTime += 1.4 * NumberOfSquares;
}
```

16	1		10

```
void FindLandingPlace(String[][] Map, MapSizeRecord MapSize, PirateRecord Pirate) {
  boolean Found = false;
  int Row = 0;
  while (!Found && Row < (MapSize.Rows)) {
    int Column = 0;
    while (!Found && Column < (MapSize.Columns)) {
      if (Map[Row][Column].equals("X")) {
        Found = true;
        Pirate.Row = Row;
        Pirate.Column = Column;
      }
      Column += 1;
    }
    Row += 1;
  }
  DisplayMap(Map, MapSize);
  Console.writeLine("X marks the spot where the pirate comes ashore");
  Console.writeLine();
  Console.write("Do you want the pirate to land elsewhere? (Y/N): ");
  String Answer = Console.readLine();  // MP3
  if (Answer.equals("Y")) {
    Row = 0;
    int Column = 0;
    Console.write("Which row is the pirate coming ashore? ");
    Row = Integer.parseInt(Console.readLine());  // MP1
    Console.write("Which column is the pirate coming ashore? ");
    Column = Integer.parseInt(Console.readLine());  // MP4
    boolean OnSand = false;
    boolean NextToWater = false;
    if (Map[Row][Column].equals(SAND)) {  // MP5
      OnSand = true;
    }
    if (Map[Row-1][Column].equals(WATER) || Map[Row+1][Column].equals(WATER)) {
      NextToWater = true;
    }
    if (Map[Row][Column].equals(WATER) || Map[Row][Column-1].equals(WATER)) {
      NextToWater = true;  // MP2  // MP6
    }
    if (OnSand && NextToWater) {  // MP7
      Pirate.Row = Row;
      Pirate.Column = Column;  // MP8
      Map[Row][Column] = PIRATES;
      DisplayMap(Map, MapSize);  // MP9
    } else {
      Console.writeLine("That was not a good landing place, so the pirate lands at
X");  // MP10
    }
  }
}
```

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```
boolean WestOfHut(String[][] Map, PirateRecord Pirate) {
  return Map[Pirate.Row][Pirate.Column + 1].equals(HUT); // MP1 MP4 Task 1
}

void GetClue(String[][] Map, MapSizeRecord MapSize, String[][] HiddenMap,
PirateRecord Pirate) {  // MP5 Task 2
  int RockRow = 0, RockColumn = 0, TreasureRow = 0, TreasureColumn = 0;
  for (int row = 0; row < MapSize.Rows; row++) {
    for (int column = 0; column < MapSize.Columns; column++) {  // MP2
      if (Map[row][column].equals(ROCK)) {  // MP6
        RockRow = row;
        RockColumn = column;
      }
    }
  }
  for (int row = 0; row < MapSize.Rows; row++) {
    for (int column=0; column < MapSize.Columns; column++) {
      if (HiddenMap[row][column].equals(TREASURE)) {  // MP7
        TreasureRow = row;
        TreasureColumn = column;
      }
    }
  }
  int DistanceFromRock_NS = TreasureRow - RockRow;  // MP3
  if (DistanceFromRock_NS < 0) {
    DistanceFromRock_NS *= -1;
  }
  int DistanceFromRock_WE = TreasureColumn - RockColumn;  // MP6
  if (DistanceFromRock_WE < 0) {
    DistanceFromRock_WE *= -1;  // MP10
  }
  Console.writeLine("The treasure is " + DistanceFromRock_NS + " squares
away from the rock in the North - South direction");
  Console.writeLine("The treasure is " + DistanceFromRock_WE + " squares
away from the rock in the East - West direction");  // MP9
}

void PirateWalks(String[][] Map, MapSizeRecord MapSize, String[][]
HiddenMap, PirateRecord Pirate) {
  boolean ObstacleInPath = true;
  boolean ValidDistance = false;
  boolean ValidDirection = false;
  int Row = 0, Column = 0, NumberOfSquares = 0;
  String Direction = "";
  while (ObstacleInPath || !ValidDistance || !ValidDirection) {
    Console.write("Enter length (1 to 9) and direction (N, NE, E, SE, S, SW,
W, NW): ");
    String WalkData = Console.readLine();
    Row = Pirate.Row;
    Column = Pirate.Column;
    MoveCheckRecord DistanceData =
CheckDistance(String.valueOf(WalkData.charAt(0)));
    ValidDistance = DistanceData.valid;
    NumberOfSquares = DistanceData.numberOfSquares;
    Direction = WalkData.substring(1);
    MoveCheckRecord DirectionData = CheckDirection(Direction, Row, Column,
NumberOfSquares);
    ValidDirection = DirectionData.valid;
    Row = DirectionData.row;
    Column = DirectionData.column;
```

```
    if (Row >= MapSize.Rows || Column >= MapSize.Columns || Row < 0 ||
Column < 0) {
      ValidDirection = false;
      Console.writeLine("Error");
    }
    if (ValidDirection) {
      ObstacleInPath = CheckPath(Map, Pirate.Row, Pirate.Column, Row,
Column, Direction);
      if (ObstacleInPath) {
        Console.writeLine("Pirate can't walk this way as there is an
obstacle in the way");
      }
    }
  }
  Move(Map, MapSize, Pirate, Row, Column);
  if (WestOfHut(Map, Pirate)) {  // MP11 Task 3
    GetClue(Map, MapSize, HiddenMap, Pirate);  // MP12
  }
}
```