



Mark Scheme (Results)

Summer 2025

Pearson Edexcel GCSE

In Computer Science (1CP2/02)

Paper 02: Application of Computational
Thinking

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General marking guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed-out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	MP	Appx . Line	Answer	Additional guidance	Mark
1			Award marks as shown.	Ignore precision on decimal places	(9)
	1.1	4	Add comment symbol in front of 'Cost of meals'	- Do not award where the entire comment is deleted # Cost of meals	
	1.2	6	Remove space between 'cost' and 'Drinks' to create a correct variable name	- costDrinks = 2.00 - Do not award removing cost or Drinks - Allow any amendments that result in a syntactically correct identifier that is in context	
	1.3	10	Turn the assignment around the right way. Instruction cannot start with a number.	numDrinks = 0	
	1.4	28	Remove double quotes from around "num2Courses"	total = num2Courses * cost2Courses	
	1.5	29	Correct typo from 'cost33Courses' to 'cost3Courses'	total = total + num3Courses * cost3Courses	
	1.6	33	Replace subtraction with addition	if (num2Courses + num3Courses > 8):	
	1.7	34	Replace addition with multiplication	total = 0.85 * total	
	1.8	38	Correct spelling from 'tatol' to 'total'	total = 0.95 * total	
	1.9	40	Indent the print statement under the 'else'		

Test data:

Two-course dinners	Three-course dinners	Drinks	Discount	Output	Additional guidance
2	2	5		Meals and drinks don't match	
5	6	11	15%	184.45	Ignore formatting of decimal values
1	5	6	10%	114.3	
5	0	5	5%	80.75	
1	2	3	No discount	61.0	

```

1  # -----
2  # Global variables
3  # -----
4  cost2Courses = 15.00          # Cost of meals
5  cost3Courses = 20.00
6  costDrinks = 2.00
7
8  num2Courses = 0              # Number of meals
9  num3Courses = 0
10 numDrinks = 0
11
12 total = 0.0                  # Total cost of all food and drink
13
14 # -----
15 # Main program
16 # -----
17
18 # Get the inputs from the user
19 num2Courses = int (input ("How many 2-course dinners? "))
20 num3Courses = int (input ("How many 3-course dinners? "))
21 numDrinks = int (input ("How many drinks? "))
22
23 # Check if everyone has a drink
24 if (numDrinks != (num2Courses + num3Courses)):
25     print ("Meals and drinks don't match")
26 else:
27     # Calculate the total cost of all meals and drinks
28     total = num2Courses * cost2Courses
29     total = total + num3Courses * cost3Courses
30     total = total + numDrinks * costDrinks
31
32     # Check if user gets a discount and apply it
33     if (num2Courses + num3Courses > 8):      # Get 15% discount
34         total = 0.85 * total
35     elif (num3Courses > 4):                  # Get 10% discount
36         total = 0.90 * total
37     elif (num2Courses > 2):                  # Get 5% discount
38         total = 0.95 * total
39
40     print ("Total is:", total)

```

Question number	MP	Appx. Line	Answer	Additional guidance	Mark
2			Award marks as shown.	Ignore indentation	(10)
	2.1	5	Import time library	<code>import time</code>	
	2.2	17	Create <code>countDown</code> and set to 0	<code>countDown = 0</code>	
	2.3	25	Take input from user AND convert to integer	<code>countDown = int (input ("What is the countdown? "))</code>	
	2.4	29	Complete two relational tests to ensure number inputted is valid	<code>(countDown <= 10)</code> <code>(countDown > 0)</code> - Ignore logical operator - Allow equivalent expressions, where given lines are changed - Allow <code>< 10</code>	
	2.5	29	Complete line with the correct logical operator	<code>((<test>) and (<test>))</code> - Ignore tests - Allow equivalent expressions, where given lines are changed - Do not award OR	
	2.6	33	Complete while loop	<code>while (countDown != 0):</code> <code>while (countDown > 0):</code> <code>Allow >= 0</code>	

	2.7	36	Display countDown	print (countDown)	
	2.8	40	Call to sleep function with accurate time	time.sleep (WAIT_TIME) • Allow time.sleep (1.5)	
	2.9	43	Reduce countDown - 1	• Allow equivalent expressions countDown = countDown - 1	
	2.10	46	Display 'lift off' inline with/outside while loop and inside if statement	print ("Ignition - lift off!") • Allow any sensible message	

```

1  # -----
2  # Import libraries
3  # -----
4  # =====> Add a line to import the time library
5  import time
6
7  # -----
8  # Constants
9  # -----
10 WAIT_TIME = 1.5
11
12 # -----
13 # Global variables
14 # -----
15 # =====> Add a line to create a variable named countDown and
16 #         set it to 0
17 countDown = 0
18
19 # -----
20 # Main program
21 # -----
22
23 # =====> Complete the line to take the input from the user and
24 #         convert it to an integer
25 countDown = int (input ("What is the countdown? "))
26
27 # =====> Complete the line to ensure the number inputted is valid
28 #         Use two relational operators and one logical operator
29 if ((countDown <= 10) and (countDown > 0)):
30
31     # =====> Complete the condition to ensure the loop
32     #         stops when it reaches 0
33     while (countDown != 0):
34
35         # =====> Add a line to display countDown for the user
36         print (countDown)
37
38         # =====> Complete the line to call a function in the time library
39         #         to pause the program for WAIT_TIME
40         time.sleep (WAIT_TIME)
41
42         # =====> Complete the line to reduce countDown by 1
43         countDown = countDown - 1
44
45     # =====> Add a line to display "Ignition - liftoff!" for the user
46     print ("Ignition - lift off!")
47

```

Question number	MP	Appx . Line	Answer	Additional guidance	Mark
3			Award marks as shown.	• Award sequence only. • Ignore intervening lines. • Ignore changes made to provided lines. • Do not award same sequence found in supplied file	(15)
			Constants and variables		
	3.1	1-15	Four constants and three variables moved before the first executable line of the main program (1)	• ZERO, THREE, FOUR, FIVE • inString, total, asciiValue • Placement does not have to be in the labelled	
			Input, outside loop, and length validation	• If no lines are moved, not changing the sequence, then award no marks in this subsection	
	3.2	21	Input taken as first line in the main program (1)		
	3.3	23	While loop comes after taking of an input call (1)	• Ignore intervening lines	
	3.4	24	If statement validating length of input string must come after taking of input (1)	• Ignore intervening lines	
			Processing and total		
	3.5	25	Resetting of total variable to 0 is done before 'for character in inString:' loop (1)	• Allow resetting outside for character in inString • Ignore intervening lines	

				Allow resetting after print (total, inString), as value will be 0 on first pass of while loop anyway	
	3.6	26	'For character in inString' loop must be inside while loop (1)	Ignore intervening lines except a line that breaks scope	
	3.7	27	Conversion of character to ASCII must be inside for loop (1)	Ignore intervening lines	
	3.8	28	Calculating new total must be done inside for loop AND after conversion to ASCII (1)	Ignore intervening lines	
			Checking divisibility		
	3.9	31, 33, 35	If/elif/else key words for checking divisibility must appear in sequence (1)	- Ignore intervening lines - Check indentation matches to make sure the three keywords are in the correct sequence. Don't allow parts of the if/else that align with the length check.	
	3.10	32, 34, 36	Concatenation (all three) of digit at the end must be inside the test in the matching selection statement (1)	- Constants can be used to see this (FOUR, FIVE, ZERO) - Do not award where code has been changed to use hard-coded numeric values	
			Outputs and going around again		
	3.11	38	Printing output must follow all three concatenation instructions (1)	- Ignore intervening lines - Ignore accuracy of MP3.10	
	3.12	39, 40	The length check (if) followed by the (else, print) pattern (1)	Ignore intervening lines <pre>if (len(inString)>=THREE):</pre>	

				<pre> • • • else: print ("String ... long") </pre>	
	3.13	42	User input accepted is last line in the code (1)		
			Additional		
	3.14		Indentation doesn't generate a syntax error (1)	Ignore accuracy of line placement and functionality	
	3.15		Functions for any sequence of characters (1)	Execute with test data given in question paper	

Test data from question paper:

Input	Output	Notes
X	String must be three or more characters long	
XY	String must be three or more characters long	
cup	328 cup4	
snow	455 snow5	
lan	280 lan4	That's an uppercase 'l' as in the name 'lan' not a 'local area network'.
HAT	221 HAT0	
<empty>	No output, but exits program	

```

1  # -----
2  # Constants
3  # -----
4  ZERO = 0
5  THREE = 3
6  FOUR = 4
7  FIVE = 5
8
9  # -----
10 # Global variables
11 # -----
12 inString = ""
13 total = 0
14 asciiValue = 0
15
16 # -----
17 # Main program
18 # -----
19
20 # Set up the input loop
21 inString = input ("Enter a string (blank to exit): ")
22
23 while (inString != ""):
24     if (len (inString) >= THREE):
25         total = 0 # Reset each pass
26         for character in inString:
27             asciiValue = ord(character)
28             total = total + asciiValue
29
30         # Check if divisible by 4, 5, or neither
31         if (total % FOUR == 0):
32             inString = inString + str (FOUR)
33         elif (total % FIVE == 0):
34             inString = inString + str (FIVE)
35         else:
36             inString = inString + str (ZERO)
37
38         print (total, inString)
39     else:
40         print ("String must be three or more characters long")
41
42     inString = input ("Enter a string (blank to exit): ")

```

Question number	MP	Appx . Line	Answer	Additional guidance	Mark
4			Award marks as shown.		
			File and input		
	4.1	22	Output file opened for writing only (the 'w' must be present)	- Any method - Allow accurate hard-coded name matching the constant provided - Allow with open () - Where using open () - check for matching close ()	
			Building output line		
	4.2	30	Value is calculated as row * column	Does not require assignment to a variable	
	4.3	31	New value is appended to outString	- Requires a type conversion - Ignore manipulation of comma for this mark - Allow any variable name for outString outString = outString + <code>str</code> (num)	
	4.4	35	Comma added as separator	- Ignore malformed output strings, but there must be the concept of a string being built - Allow hard-coded value instead of constant	
	4.5	38	Line feed added to last column in output line only	Ignore comma, if present	
			Writing to file		
	4.6	41	Output line is added to file	Do not award when the file.write() is over-indented to cause the writing of individual digits to the file. Full functionality marks are still available.	
			Closing file		(11)

	4.7	44	Output file is closed outside the 'for row' loop	Allow 'with open' where processing is indented properly	
			Overall		
	4.8	Any	Accurate use of at least one of the constants provided	OUT_FILE, COMMA, LF	
			Levels-based mark scheme to a maximum of 3, from:	Considerations for levels-based mark scheme:	
	4.9 4.10 4.11		Functionality (3)	[6.1.5] No syntax or runtime errors in a reasonable attempt to solve the problem [6.1.5] Some logic errors in a reasonable attempt to address all the requirements [6.1.6] Fully meets requirements of a solution [6.1.2] Write in a high-level language	

Output file

User enters the number 5:

Q04_OUTPUT.TXT	
1	1, 2, 3, 4, 5
2	2, 4, 6, 8, 10
3	3, 6, 9, 12, 15
4	4, 8, 12, 16, 20
5	5, 10, 15, 20, 25
6	

User enters the number 8:

Q04_OUTPUT.TXT	
1	1, 2, 3, 4, 5, 6, 7, 8
2	2, 4, 6, 8, 10, 12, 14, 16
3	3, 6, 9, 12, 15, 18, 21, 24
4	4, 8, 12, 16, 20, 24, 28, 32
5	5, 10, 15, 20, 25, 30, 35, 40
6	6, 12, 18, 24, 30, 36, 42, 48
7	7, 14, 21, 28, 35, 42, 49, 56
8	8, 16, 24, 32, 40, 48, 56, 64
9	

Functionality (levels-based mark scheme)

0	1	2	3	Max.
<i>No rewa rdabl e mate rial</i>	Functionality (when the code is run) • The component parts of the program are incorrect or incomplete, providing a program of limited functionality that meets some of the given requirements. • Program outputs are of limited accuracy and/or provide limited information. • Program responds predictably to some of the anticipated input. • Solution is not robust and may crash on anticipated or provided input.	Functionality (when the code is run) • The component parts of the program are complete, providing a functional program that meets most of the stated requirements. • Program outputs are mostly accurate and informative. • Program responds predictably to most of the anticipated input. • Solution may not be robust within the constraints of the problem.	Functionality (when the code is run) • The component parts of the program are complete, providing a functional program that fully meets the given requirements. • Program outputs are accurate, informative, and suitable for the user. • Program responds predictably to anticipated input. • Solution is robust within the constraints of the problem.	3

```

1  # -----
2  # Constants
3  # -----
4  OUT_FILE = "Q04_OUTPUT.TXT"
5  COMMA = ","
6  LF = "\n"
7
8  # -----
9  # Global variables
10 # -----
11 outString = ""
12 maxNum = 0
13 num = 0
14 row = 0
15 column = 0
16
17 # -----
18 # Main program
19 # -----
20
21 # =====> Open the output file for writing
22 theFile = open (OUT_FILE, "w")
23
24 maxNum = int (input ("Enter a number: ")) # Get the number
25 for row in range (1, maxNum + 1): # Going down the table
26     outString = ""
27
28     for column in range (1, maxNum + 1): # Going across the table
29         # =====> Calculate the new value
30         num = row * column
31         outString = outString + str (num)
32
33         # =====> Add a comma to all except last column
34         # =====> Add a line feed to the last column
35         if (column < maxNum):
36             outString = outString + COMMA
37         else:
38             outString = outString + LF
39
40     # =====> Write the row to the file
41     theFile.write (outString)
42
43 # =====> Close the file
44 theFile.close ()

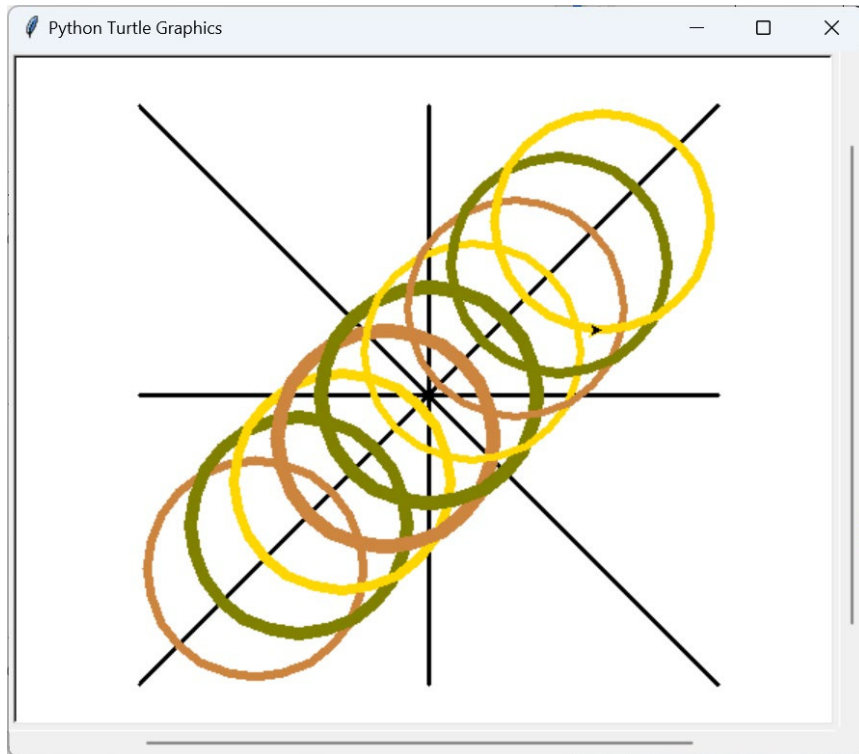
```

Question number	MP	Appx . Line	Answer	Additional guidance	Mark
5			Award marks as shown.		
			Libraries		
	5.1		Import turtle library Import random library		
			Prepare the turtle		
	5.2		Set turtle speed to fastest	Award default or new turtle <code>turtle.speed (0)</code> <code>turtle.speed ("fastest")</code>	
			Draw lines		
	5.3		A – Horizontal appx. (-200, 0) to (400, 0) B – Vertical appx. (0, 200) to (0, 400) Draw line A and line B (horizontal, vertical) in the right place	- Ignore length, colour, width, direction (left to right / right to left) of drawing and labelling of lines - Allow any method	
	5.4		C – Lower left to upper right appx. (-200, -200) for 45 degrees. D – Lower right to upper left appx. (200, -200) for 135 degrees (90+45). Draw Line C and line D (diagonals) in the right place	- Ignore length, colour, width, direction (left to right / right to left) of drawing and labelling of lines - Allow any method	
			Loop for nine		
					(15)

	5.5		Loop to draw nine circles	Allow any method <pre>for count in range (9): while index in range (0,9):</pre>	
			Circle properties		
	5.6		Circle colours follow pattern of colours in the original myColours array	- Index for colours must be generated programmatically, not hard-coded - Allow any method <pre>turtle.pencolor (myColours[count % 3])</pre> Note, for this method, index must be initialised outside the loop and incremented inside the loop <pre>index = 0 turtle.pencolor (myColours[index]) index += 1</pre>	
	5.7		Call to generate random number (5 – 10)	Ignore setting pen size <pre>turtle.pensize (random.randint (5, 10))</pre>	
	5.8		Circle radii are 75 units	<pre>turtle.circle (75)</pre>	
			Move to next position		
	5.9		Two position variables are incremented by 30 for each circle	- Arithmetic is given in the question paper. Award this mark for accurate translating of the formula and assignment to a position variable - Ignore functionality of loop <pre>xPos = xPos + 30</pre>	

				$yPos = yPos + 30$	
			Levels-based mark scheme to a maximum of 6, from:	Considerations for levels-based mark scheme:	
	5.10 5.11 5.12		Solution design (3)	• [6.5.1] Modulus used for finding colour • [6.3.2] Name and type of variables is appropriate to the problem • [6.1.4] Layout and comments aid understanding of logic	
	5.13 5.14 5.15		Functionality (3)	• [6.1.5] No syntax or runtime errors in a reasonable attempt to solve the problem • [6.1.5] Some logic errors in a reasonable attempt to address all the requirements • [6.1.6] Fully meets requirements of a solution • [6.1.2] Write in a high-level language	

Output



Solution design (levels-based mark scheme)

0	1	2	3	Max.
<i>No rewa rdabl e mate rial</i>	• There has been little attempt to decompose the problem. • Some of the component parts of the problem can be seen in the solution, although this will not be complete. • Some parts of the logic are clear and appropriate to the problem. • The use of variables and data structures, appropriate to the problem, is limited. • The choice of programming constructs, appropriate to the problem, is limited.	• There has been some attempt to decompose the problem. • Most of the component parts of the problem can be seen in the solution. • Most parts of the logic are clear and appropriate to the problem. • The use of variables and data structures is mostly appropriate. • The choice of programming constructs is mostly appropriate to the problem.	• The problem has been decomposed clearly into component parts. • The component parts of the problem can be seen clearly in the solution. • The logic is clear and appropriate to the problem. • The choice of variables and data structures is appropriate to the problem. • The choice of programming constructs is accurate and appropriate to the problem.	3

Functionality (levels-based mark scheme)

0	1	2	3	Max.
<i>No rewa rdabl e mate rial</i>	Functionality (when the code is run) • The component parts of the program are incorrect or incomplete, providing a program of limited functionality that meets some of the given requirements. • Program outputs are of limited accuracy and/or provide limited information. • Program responds predictably to some of the anticipated input. • Solution is not robust and may crash on anticipated or provided input.	Functionality (when the code is run) • The component parts of the program are complete, providing a functional program that meets most of the stated requirements. • Program outputs are mostly accurate and informative. • Program responds predictably to most of the anticipated input. • Solution may not be robust within the constraints of the problem.	Functionality (when the code is run) • The component parts of the program are complete, providing a functional program that fully meets the given requirements. • Program outputs are accurate, informative, and suitable for the user. • Program responds predictably to anticipated input. • Solution is robust within the constraints of the problem.	3

```

1  # -----
2  # Import libraries
3  # -----
4  # ==> Import the required libraries
5  import turtle
6  import random
7
8  # -----
9  # Constants
10 # -----
11 WIDTH = 800
12 HEIGHT = 600
13
14 # -----
15 # Global variables
16 # -----
17 myColours = ["peru", "olive", "gold"]
18 xPos = -120      # Location of circle 1, turtle pointing east
19 yPos = -195
20
21 # -----
22 # Main program
23 # -----
24 turtle.mode ("standard")      # Turtle points to the east
25                                # Angles are counterclockwise
26 screen = turtle.Screen ()
27 screen.setup (WIDTH, HEIGHT)
28 turtle.screensize (WIDTH, HEIGHT)
29
30 # -----
31 # ==> Prepare the turtle, including speed
32 theTurtle = turtle.Turtle ()
33 theTurtle.speed (0)
34 theTurtle.penup ()
35

```

```

36 # =====> Draw Line A and Line B
37 theTurtle.pensize (3)
38 theTurtle.pencolor ("Black")
39 theTurtle.setposition (-200, 0)
40 theTurtle.setheading (0)
41 theTurtle.pendown ()
42 theTurtle.forward (400)
43 theTurtle.penup ()
44 theTurtle.setposition (0, 200)
45 theTurtle.setheading (270)
46 theTurtle.pendown ()
47 theTurtle.forward (400)
48 theTurtle.penup ()
49
50 # =====> Draw Line C and Line D
51 theTurtle.setposition (-200, -200)
52 theTurtle.setheading (45)
53 theTurtle.pendown ()
54 theTurtle.forward (566)
55 theTurtle.penup ()
56 theTurtle.setposition (200, -200)
57 theTurtle.setheading (135)
58 theTurtle.pendown ()
59 theTurtle.forward (566)
60 theTurtle.penup ()
61 #
62 # =====> Draw nine coloured circles
63 theTurtle.setheading (0) # theTurtle.home ()
64 for count in range (9):
65     theTurtle.setposition (xPos, yPos)
66     theTurtle.pendown ()
67     theTurtle.pencolor (myColours[count % 3])
68     theTurtle.pensize (random.randint (5, 10))
69     theTurtle.circle (75)
70     theTurtle.penup ()
71     xPos = xPos + 30 # Change X-axis by 30 units
72     yPos = yPos + 30 # Change Y-axis by 30 units
73
74 # -----
75 turtle.done ()
76

```

Question number	MP	Appx . Line	Answer	Additional guidance	Mark
6			Award marks as shown.		
	6.1		Loop for processing every record in the array	- Any method - Use of for/for each expected - for record in theRecords: - for index in range (len (theRecords)):	
	6.2		Range check on signal >= MIN_SIGNAL AND Range check on signal <= MAX_SIGNAL	- Lower bound - Allow 1 or 1.0 for lower bound - Allow 5 or 5.0 for upper bound - Allow equivalent statement - Allow reversed logic for invalid check	
	6.3		Mechanism for excluding non-alphanumeric characters, e.g. &	- Any method - Must exclude other characters, e.g. & - Do not award malformed function calls	
	6.4		Length check used to determine if key is valid or invalid.	- Any method - Testing for valid key: len (inKey) >= MIN_KEY_LENGTH) - Testing for invalid key: len (inKey) < MIN_KEY_LENGTH) - Code following test must match intent of the test - Allow > for >=	
					(15)

	6.5		Mechanism for summing digits in the key	- Any method - Use of for() expected - Use of isdigit() expected - Use of int() expected - Allow not <string>.isalpha(), to skip over characters, rather than use of <string>.isdigit() to choose digits	
	6.6		Indication of two-dimensional indexing (key, reading)	Any method	
			Levels-based mark scheme to a maximum of 9, from:	Considerations for levels-based mark scheme:	
	6.7 6.8 6.9		Solution design (3)	[6.3.2] Use of constants throughout [6.4.3] Length check of strings (key) should be done to prevent indexing errors when key is too short [6.6.2] Use of subprograms (ideal problem for using isValid...)	
	6.10 6.11 6.12		Good programming practices (3)	[6.1.4] Layout in visible sections with good, but not excessive, use of white space [6.1.4] Sufficient, but not excessive, comments provided to explain blocks of logic [6.1.4] Variable names are meaningful and data types appropriate to the problem and solution	
	6.13 6.14		Functionality (3)	[6.1.5] No syntax or runtime errors in a reasonable attempt to solve the problem	

	6.15			• [6.1.5] Some logic errors in a reasonable attempt to address all the requirements • [6.1.5] Fully meets requirements of a solution • [6.4.1] User is informed which field is invalid, not just which record is invalid • [6.1.1] Use decomposition to solve problem and create solution • [6.1.2] Write in a high-level language	
--	------	--	--	--	--

Required Output (ignore format):

Invalid key ['7JA3B1', 3.41]

Invalid key ['A7B', 2.33]

Invalid key ['Y8R4K', 2.78]

Invalid key ['A1&2X3', 1.25]

Invalid signal ['B1P6Y7', -1.23]

Invalid signal ['F8D7L5', 5.17]

Invalid signal ['X0B9A9', 0]

Invalid signal ['Q6B7T3', 0.5]

Invalid key ['P3Y1M4V7', 4.35]

Invalid key ['X', 2.3]

Invalid key ['W64T18B1', 1.51]

Invalid key ['A3B1C14', 4.59]

Test data:

Record	Where	Reason
['7JA3B1', 3.41]	Key	Incorrect checksum
['A7B', 2.33]	Key	Missing checksum digit / checksum not equal to last character
['Y8R4K', 2.78]	Key	Does not end with a digit / checksum not equal to last character
['A1&2X3', 1.25]	Key	Contains a symbol, not alphabetic and digits only
['B1P6Y7', -1.23]	Signal	Below minimum
['F8D7L5', 5.17]	Signal	Above maximum
['X0B9A9', 0]	Signal	Below minimum
['Q6B7T3', 0.5]	Signal	Below minimum
['P3Y1M4V7', 4.35]	Key	Incorrect checksum
['X', 2.3]	Key	Key too short
['W64T18B1', 1.51]	Key	Incorrect checksum
['A3B1C14', 4.59]	Key	Incorrect checksum

Solution design (levels-based mark scheme)

0	1	2	3	Max.
<i>No rewa rdabl e mate rial</i>	• There has been little attempt to decompose the problem. • Some of the component parts of the problem can be seen in the solution, although this will not be complete. • Some parts of the logic are clear and appropriate to the problem. • The use of variables and data structures, appropriate to the problem, is limited. • The choice of programming constructs, appropriate to the problem, is limited.	• There has been some attempt to decompose the problem. • Most of the component parts of the problem can be seen in the solution. • Most parts of the logic are clear and appropriate to the problem. • The use of variables and data structures is mostly appropriate. • The choice of programming constructs is mostly appropriate to the problem.	• The problem has been decomposed clearly into component parts. • The component parts of the problem can be seen clearly in the solution. • The logic is clear and appropriate to the problem. • The choice of variables and data structures is appropriate to the problem. • The choice of programming constructs is accurate and appropriate to the problem.	3

Good programming practices (levels-based mark scheme)

0	1	2	3	Max.
<i>No rewa rdabl e mate rial</i>	• There has been little attempt to lay out the code into identifiable sections to aid readability. • Some use of meaningful variable names. • Limited or excessive commenting. • Parts of the code are clear, with limited use of appropriate spacing and indentation.	• There has been some attempt to lay out the code to aid readability, although sections may still be mixed. • Uses mostly meaningful variable names. • Some use of appropriate commenting, although may be excessive. • Code is mostly clear, with some use of appropriate white space to aid readability.	• Layout of code is effective in separating sections, e.g. putting all variables together, putting all subprograms together as appropriate. • Meaningful variable names and subprogram interfaces are used where appropriate. • Effective commenting is used to explain logic of code blocks. • Code is clear, with good use of white space to aid readability.	3

Functionality (levels-based mark scheme)

0	1	2	3	Max.
<i>No rewa rdabl e mate rial</i>	Functionality (when the code is run) • The component parts of the program are incorrect or incomplete, providing a program of limited functionality that meets some of the given requirements. • Program outputs are of limited accuracy and/or provide limited information. • Program responds predictably to some of the anticipated input. • Solution is not robust and may crash on anticipated or provided input.	Functionality (when the code is run) • The component parts of the program are complete, providing a functional program that meets most of the stated requirements. • Program outputs are mostly accurate and informative. • Program responds predictably to most of the anticipated input. • Solution may not be robust within the constraints of the problem.	Functionality (when the code is run) • The component parts of the program are complete, providing a functional program that fully meets the given requirements. • Program outputs are accurate, informative, and suitable for the user. • Program responds predictably to anticipated input. • Solution is robust within the constraints of the problem.	3

```

1  # -----
2  # Constants
3  # -----
4  MIN_KEY_LENGTH = 3          # A00
5  MAX_SIGNAL = 5.0           # Max five
6  MIN_SIGNAL = 1.0           # Min 1
7
8  # -----
9  # Global variables
10 # -----
11 theRecords = [{"7JA3B1", 3.41}, {"A7B", 2.33}, {"Y8R4K", 2.78},
12               {"O9N1K0", 5.0}, {"A1&2X3", 1.25},
13               {"A12B3", 2.47}, {"B1P6Y7", -1.23}, {"F8D7L5", 5.17},
14               {"AB23A5", 2.47}, {"X0B9A9", 0}, {"Q6B7T3", 0.5},
15               {"A15B6C2", 2.56}, {"A12340", 2.5}, {"P3Y1M4V7", 4.35},
16               {"J1H0Q1", 1.0}, {"X", 2.3}, {"W64T18B1", 1.51},
17               {"A00", 1.99}, {"A3B1C14", 4.59}
18           ]
19
20 # -----
21 # Subprograms
22 # -----
23 def isKeyValid (pKey):
24     valid = False
25
26     # Length, mixture of letters and digits, ends with a digit
27     # Not only letters, not only digits
28     # No requirement to start with an uppercase letter
29     if ((len (pKey) >= MIN_KEY_LENGTH) and (pKey.isalnum()) and
30         (pKey[len (pKey) - 1].isdigit()) and
31         (not pKey[0:len (pKey) - 1].isalpha ()) and
32         (not pKey[0:len (pKey) - 1].isdigit ())):
33         valid = True
34
35     return (valid)
36
37 def calcCheckDigit (pKey):
38     index = 0
39     total = 0
40
41     while (index < (len (pKey) - 2)):          # One short of check digit
42         if (pKey[index].isdigit ()):
43             total = total + int (pKey[index])
44             index = index + 1
45
46     # Only want the last digit of the calculated check digit
47     strTotal = str (total)
48     chkDigit = strTotal[len (strTotal) - 1]
49
50     return (chkDigit)
51

```

```

52 def isSignalValid (pSignal):
53     valid = False
54
55     if ((pSignal >= MIN_SIGNAL) and (pSignal <= MAX_SIGNAL)):
56         valid = True
57
58     return (valid)
59
60 # -----
61 # Main program
62 # -----
63
64 for record in theRecords:
65     keyPart = record[0]                # Ease of reading
66     signalPart = record[1]
67     checkDigitLocation = len (keyPart) - 1
68     checkDigit = ""                   # A string for comparison
69
70     if (isKeyValid (keyPart)):
71         checkDigit = calcCheckDigit(keyPart)
72         if (checkDigit == keyPart[checkDigitLocation]):
73             if (not isSignalValid (signalPart)):
74                 print ("Invalid signal", record)
75             else:
76                 print ("Invalid key", record)
77         else:
78             print ("Invalid key", record)

```