2.3 Producing Robust Programs: 30-minute Pack

OCR J277 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Study the following algorithm, written in OCR Exam Reference Language:

```
total = 0
count = 0
array numbers[5]
numbers[0] = 12
numbers[1] = 7
numbers[2] = 25
numbers[3] = 3
numbers[4] = 18
for i = 0 to 4
if numbers[i] > 10 then
total = total + numbers[i]
count = count + 1
endif
next i
```

```
print(total)
print(count)
```

(a) Complete a trace table for this algorithm, showing the value of i, numbers[i], total and count for each pass of the loop. **(4)**

(b) State the two values output by the program. **(2)**

(Total for Question 1 is 6 marks)

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2 Binary and denary conversions (no calculator).

(a) Convert the denary number 173 to an 8-bit binary number. Show your working. **(2)**

(b) Convert the 8-bit binary number 11010110 to denary. **(2)**

(Total for Question 2 is 4 marks)

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3 A programmer is using an IDE to try to find the cause of a bug in their program.

(a) Identify two tools, other than a syntax checker, provided by an IDE that can help a programmer to find the cause of an error in their code. **(2)**

(b) Explain how using breakpoints together with single stepping can help a programmer to find the cause of a logic error. **(3)**

(Total for Question 3 is 5 marks)

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4 A warehouse uses a 7-digit product code. The final digit is a check digit calculated as follows: each of the first 6 digits is multiplied by a weight (7, 6, 5, 4, 3, 2, reading left to right), the six results are added together, and the check digit is the remainder when this sum is divided by 11 (if the remainder is 10, the check digit is 0). The first 6 digits of a new product code are 3 4 5 2 1 6.

(a) Calculate the check digit for this product code. Show your working. **(3)**

(b) State the name of this type of validation check and give one real-world example of where a check digit is used. **(2)**

(Total for Question 4 is 5 marks)

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5 Write an algorithm, using pseudocode (OCR Exam Reference Language), that repeatedly asks the user to input a whole number from 1 to 10 inclusive. The algorithm must reject and re-ask for any number outside this range, and once a valid number has been entered, it should output that number. Any correct logic will be accepted; do not worry about minor syntax errors.

(Total for Question 5 is 5 marks)

6 Amara is writing a program in an IDE.

(a) Amara's program will not run. The IDE highlights a missing ENDIF and displays an error message before the program starts. State the type of error this is. **(1)**

(b) Amara fixes this, and the program now runs, but it displays the wrong total every time. State the type of error this is now most likely to be. **(1)**

(c) Explain why the IDE's syntax checker did not detect the error described in part (b). **(2)**

(Total for Question 6 is 4 marks)

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Mark scheme · 2.3 Producing Robust Programs: 30-minute Pack

Question 1

(a) i=0: numbers[0]=12, condition true, total=12, count=1 **B1**

(a) i=1: numbers[1]=7, condition false, total and count unchanged (12, 1) **B1**

(a) i=2 and i=3: numbers[2]=25 true (total=37, count=2); numbers[3]=3 false (unchanged) **B1**

(a) i=4: numbers[4]=18, condition true, final total=55, count=3 **B1**

(a) Answer: i=0: 12, true, total=12, count=1 | i=1: 7, false, total=12, count=1 | i=2: 25, true, total=37, count=2 | i=3: 3, false, total=37, count=2 | i=4: 18, true, total=55, count=3

(b) total = 55 cao **B1**

(b) count = 3 cao **B1**

(b) Answer: total = 55, count = 3

Question 2

(a) Correct method shown using place values 128, 64, 32, 16, 8, 4, 2, 1 **M1**

(a) 10101101 cao **A1**

(a) Answer: 10101101

(b) Correct method shown, e.g. adding place values for each set bit **M1**

(b) 214 cao **A1**

(b) Answer: 214

Question 3

(a) First valid tool, e.g. breakpoints **B1**

(a) Second valid tool, e.g. single stepping (step through/step into/step over) / variable (watch) window / cross-reference tool **B1**

(a) Answer: Any two of: breakpoints; single stepping (stepping through code line by line); a variable/watch window; a cross-reference tool.

(b) A breakpoint pauses execution of the program at a chosen line **M1**

(b) Single stepping then executes the remaining code one line/instruction at a time while the programmer watches variable values **M1**

(b) This lets the programmer identify exactly which line causes a variable to take an unexpected/incorrect value, pinpointing the cause of the logic error **A1**

(b) Answer: A breakpoint pauses the program at a chosen line, then single stepping runs the remaining code one instruction at a time so the programmer can watch how each variable's value changes and identify exactly which line causes a value to become incorrect, pinpointing the logic error.

Question 4

(a) Correct products shown: 3x7=21, 4x6=24, 5x5=25, 2x4=8, 1x3=3, 6x2=12 **M1**

(a) Correct total sum = 93 **M1**

(a) Check digit = 5 cao **A1**

(a) Answer: 5

(b) Check digit (check-digit validation) **B1**

(b) Any one valid real-world example, e.g. barcodes, ISBNs, bank account numbers **B1**

(b) Answer: Check digit; used, for example, in barcodes, ISBNs or bank account numbers.

Question 5

Uses a loop that repeats the input process, e.g. do...until or while...endwhile **1**

An input() statement used inside the loop to accept the number from the user **1**

A condition correctly tests whether the number is outside the range 1 to 10, e.g. number < 1 OR number > 10 **1**

The loop correctly continues while/until the number is invalid, and stops once a valid number (1 to 10) is entered **1**

A print() statement used after the loop to display the valid number **1**

Answer:do
number = int(input("Enter a whole number from 1 to 10"))
if number < 1 OR number > 10 then

```
    print("Invalid, please try again")
endif
```

until number ≥ 1 AND number ≤ 10

```
print(number)
```

Question 6

(a) Syntax error **B1**

(a) Answer: Syntax error

(b) Logic error **B1**

(b) Answer: Logic error

(c) A syntax checker only checks that the code follows the grammar/rules of the programming language **M1**

(c) It cannot check whether the logic/algorithm produces the correct or intended result **A1**

(c) Answer: A syntax checker only checks that the code follows the grammar/rules of the programming language; it cannot tell whether the logic of the algorithm actually produces the correct/intended output.

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