2015 specification
first exams in 2016

AS — **OCR**

Topic Tests

for AS OCR Computer Science

Component 2

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Contents

Teacher's Introduction

This resource is designed to support teaching and learning of the AS OCR specification (for first teaching in September 2015; first exams from June 2016).

These end-of-topic tests are designed as factual tests to check your students' understanding as they complete each topic*. Their primary focus is not to provide exam-style practice, but instead to test the knowledge, skills and understanding required by the OCR specification in a variety of styles and complexities – ranging from simple short-answer questions through to longer essay-style questions.

The tests could also be used for homework or revision, but their best use is as summative assessments.

The tests cover the prescribed specification content for *Component 2* of the AS OCR specification – each provided in worksheet format (with answer lines) and a more photocopy-friendly format (without answer lines), to give you flexibility of use.

Each test is worth between 20–40 marks, and can be completed comfortably within a single one-hour lesson. Example answers are provided for every test. *Note that credit should also be given for any valid responses that are not explicitly included in this resource.*

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* resulting from minor specification changes, suggestions from teachers
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2.1.1–5 Computational Thinking 1

1. You have been tasked with developing a library that contains a single functio[n] of floating-point values and returns a new array containing the same values [...]

   a) Identify the information about the input array that `fsort` would req[uire]

   ....

   ....

   b) Explain the benefit of placing `fsort` into a library rather than direct[ly]

   ....

   ....

   ....

   c) A [syste]m that the library will be used on contains a processor with [...] for sorting floating-point numbers. Give two ways you could make a[...] instruction on this platform. Which method would you recommend a[nd]

   1 ....

   ....

   ....

   2 ....

   ....

   ....

2. A programmer has a problem. They want to log debug information to eit[her] depending on an option the user has set. This has led to their code conta[ining] code repeatedly:

```
msg = "..."
if options.getPrintToScreen() then
    print(msg)
elseif options.getPrintToFile() then
    options.getFile().write(msg)
endif
```

   a) Propose a way of redu[cing the am]ount of repetition in their code.

   ....

   ....

   b) Explain how your proposal would make it easier to add new features[...] adding a timestamp as a prefix to each message.

   ....

   ....

   ....

3. Consider the following design brief for a new contactless ticketing system

'The customer will walk up to the screen in the cinema that is showing the mc
screen there will be a barrier, a touchscreen display, a receipt printer and a pc
payment card on. The customer will use the touchscreen to select the number
to buy. The customer will then tap their contactless card on the pad. If the pay
asking them to go to reception. If the payment succeeds a message will be ser
the screen telling it to let in the number of people tickets have just been boug

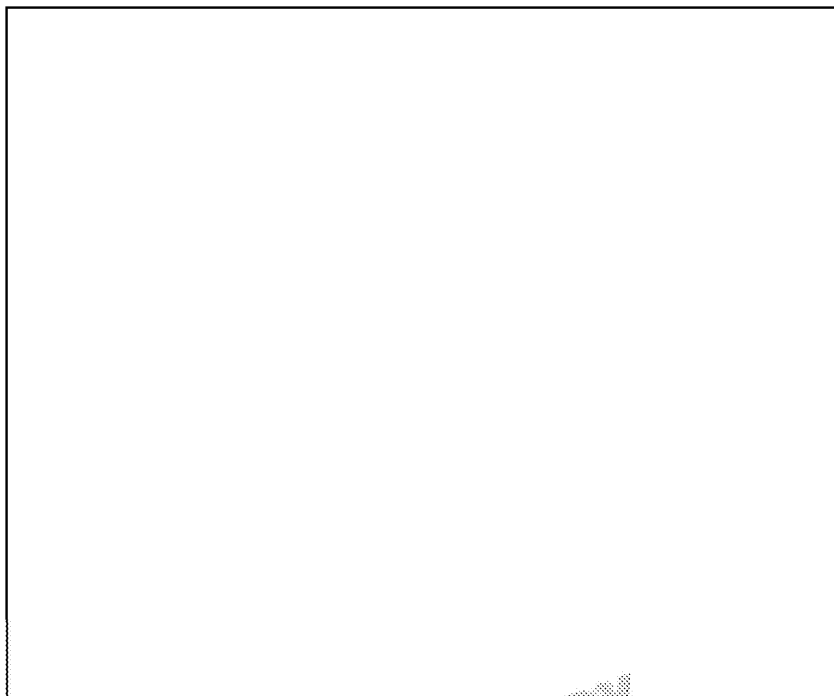a) Identify all the inputs of the ticketing system described.

....

....

b) Identify all the outputs of the ticketing system described.

....

....

c) Draw a flow chart representing the process described.

d) Convert the process shown in the flow chart into pseudocode.

2.1.1–5 Computational Thinking 2

1. Imagine you have been put in charge of developing an application that w[...]
    room in the event of a fire.

    a) A model is an example of an abstraction. Explain what abstraction is and[...]

    ....

    ....

    ....

    b) Identify four inputs that your model will need in order to calculate[...]
        could be evacuated.

    ....

    ....

    ....

    ....

    ....

    c) Explain why the speed of a real evacuation might differ from the speed[...]

    ....

    ....

    ....

    ....

2. While reading ASCII-encoded text from a network you run into the proble[...]
    wrong order. The order of every group of four bytes is reversed. So, for e[...]

    ```
    TRANSMITTED OVER THE NETWORK
    ```

    would be read as:

    ```
    NARTTIMS DETREVOEHT [...] OW
    ```

    a) Use pseudo[...] write a procedure that unscrambles a complete [...]
        A[...] th[...] the message length is a multiple of four bytes.

b) There are a number of different applications that need to receive dat
you could share the procedure you have written between them.

....

....

c) Data that is sent over the network can be compressed. The bytes are co
Use the procedure you wrote in part (a) to write a procedure that unscr
message. You may use the procedure `decompress` to decompress the

3. People who have difficulty reading text on a website can make use of spe
selected words on the screen aloud to them.

a) Identify the inputs and outputs of screen-reading software.

....

....

b) It can be difficult for people who have difficulty seeing things on scre
website that they are interested in to be read ... Describe an appro
to overcome this problem.

....

....

....

....

....

2.1.1–5 Computational Thinking 1

1. You have been tasked with developing a library that contains a single functio̶
   of floating-point values and returns a new array containing the same values ̶

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   c) A platform that the library will be used on contains a processor with ̶
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   *'The customer will walk up to the screen in the cinema that is showing the mc̶
   screen there will be a barrier, a touchscreen display, a receipt printer and a pc̶
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   asking them to go to reception. If the payment succeeds a message will be ser̶
   the screen telling it to let in the number of people tickets have just been boug̶*

   a) Identify all the inputs of the ticketing system described.

   b) Identify all the outputs of the ticketing system described.

   c) Draw a flow chart representing the process de̶ ̶ ̶ ̶ed.

   d) Convert the process shown in the ̶ ̶ w ̶h ̶ ̶ ̶nto pseudocode.

2.1.1–5 Computational Thinking 2

1. Imagine you have been put in charge of developing an application that w
   room in the event of a fire.

   a) A model is an example of an abstraction. Explain what abstraction is and

   b) Identify four inputs that your model would need in order to calculate
      could be evacuated.

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   wrong order. The order of every group of four bytes is reversed. So, for e

   TRANSMITTED OVER THE NETWORK

   would be read as:

   NART ... DE EVOEHT TEN KROW

   a) Use pseudocode to write a procedure that unscrambles a complete m
      Assume that the message length is a multiple of four bytes.

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   a) Identify the inputs and outputs of screen-reading software.

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      website that they are interested in to be read out. Describe an appro
      to overcome this problem.

Preview of Questions Ends Here

2.2.1 Programming Techniques

1. A – Variable declaration (1 mark)
   B – Selection (1 mark)
   C – Iteration (1 mark)

2. a) The value of a constant cannot be changed during the course of a progr[...]
   variable represents can be.

   b) A global variable is accessible to every subroutine/procedure/function in[...]
   whereas a local variable is limited to the scope in which it was declared ([...]

   c) Parameters allow variables to be passed to and between functions/proc[...]
   that global variables should not be needed as all the data required by fu[...]
   through parameters (1 mark).

   d) It makes it very difficult to und[...] their code. They should use varial[...]
   function they are perf[...]

3. a) Inte[...]ed [...]ment Environment

   b) A[...]pletion suggests ways that the text a programmer writes coul[...]
   no[...]ve to type an entire variable name, function name or other symbo[...]
   programmers because they do not need to remember the exact name th[...]
   harder to make a mistake (1 mark).

   c) i. A breakpoint allows the programmer to stop the execution of a pr[...]
   source code (1 mark) so that the programmer can analyse the state[...]
   stage in its execution (1 mark).

   ii. Compiler optimisations might remove variables that the programm[...]
   or change the logic of the program (for example removing a loop),[...]
   programmer to understand what is going on (1 mark).

4.
```
function factorial(n)
    result = 1
    for i = 2 to n
        result = result * i
    next i
    return result
endfunction
```

2.3.1 Algorithms

1. a) *Up to 3 marks for a valid description of the process, e.g.*

   - 17 would be placed in the first empty slot in th[...] ray.
   - It would then be compared with the v[...] [...]e [...]ft of it (21) and sw[...]
     smaller.
   - It would then be comp[...] [...]it [...]he next value to the left of it (18) ar[...]
     smaller again.
   - It [...]ould [...] [...]compared with the next value to the left of it (16) ar[...]
     [...]he [...]an 16 so the array is now sorted.

   b) The insertion sort needs a large number of element shifts which is ineffi[...]
   as the number of elements is increased the performance of the program[...]

2. a) *Up to 2 marks for a valid description of the process, e.g.*

   - Bubble sort steps through the list comparing each pair of items in th[...]
   - And swapping them if they are in the wrong order
   - The pass through the list is repeated until no swaps are needed

b) Main disadvantage is that it can take a maximum of (N-1) scans to fully ⟨sort⟩ the list that needs to be sorted (1 mark); this is because an out-of-positi⟨on item moves⟩ (or swapped) one position per scan (1 mark).

c) 1 mark for each of the three 'bubbles' (line 2, 4, 6) and 1 for overall accu⟨racy⟩

Swapped	Count	Length(A)	Temp	height			
				1	2	3	4
False		4	null	90	7	99	63
True	1		90	7	90		
	2						
True	3		99			63	99
False	1						
True	2		90		63	90	99
	3						
False							
	3						

d) 1: 7, 2: 63, 3: 90, 4: 99

3. a) It is not sorted

b) Array is sorted. 10/1 = 5.5 so midpoint is 5.

1	2	3	4	5	6	7	8	9
14	18	19	20	21	22	23	24	2⟨5⟩
⇧				⇧				
Left				Mid				

21 is less than 24 so mid and everything left of it is discarded.

6	7	8	9	10
22	23	24	25	27
⇧		⇧		⇧
Left		Mid		Right

Mid is now 24 so we have found the answer in two steps. Also accept a⟨⟩ midpoint of 6, followed by 9 and then 8, solving the problem in three st⟨eps.⟩

c) Advantage: more efficient than the linear search, as elements can be fou⟨nd faster⟩ (1 mark). Disadvantage: the data needs to be sorted (1 mark).

d) In a linear search, each element in the list is examined until the target va⟨lue is found;⟩ considerable time for a large array (1 mark).

In a binary search the number of element⟨s being⟩ examined is halved for ⟨each iteration of the⟩ program (1 mark).

4. a) A queue is ⟨a⟩ first ⟨in⟩ first out (FIFO) data structure. (1 mark) A stack is firs⟨t⟩

b) 8⟨9,45,77,⟩56

c) 3 marks for a valid working algorithm; deduct marks for errors accordingl⟨y⟩

```
FUNCTION add(stack) RETURNS INTEGER
   total = 0
   WHILE stack is not empty
      total = total + stack.pop()
   END WHILE
RETURN total
```

d) 89,45,77,56

Preview of Answers Ends Here