

Original practice questions · 56 marks · about 80 minutes · spec 1.4.2(b)(c)

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3

Total: 4 marks

The same stack uses a global array `numbers` (100 elements) and pointer `topStack`, which holds the index of the next free space and starts at 0.

- (a) Write the function `pop ( )`. It returns the string "EMPTY" if the stack is empty; otherwise it returns the item removed and updates `topStack`. [3]

- (b) Explain why `topStack` must be decremented **before** the item is read. [1]

4

Total: 5 marks

A program reverses data using the stack. The main program inputs 8 characters one at a time, using `push ( )` for each, then uses `pop ( )` to output all 8 characters. Write the main program. [5]

5 *

Total: 4 marks

Describe how a stack is used by a processor to manage subroutine (procedure) calls, including what happens when a subroutine is called and when it returns. [4]

Section B — Queues

A queue is a First In, First Out (FIFO) structure.

6

Total: 5 marks

A linear (non-circular) queue is stored in a zero-indexed array `theQueue` of size 6. `headPointer` holds the index of the front item; `tailPointer` holds the index of the next free space. The current state is:

index	0	1	2	3	4	5
value			"A"	"B"	"C"	

`headPointer = 2` `tailPointer = 5`

(a) Give the values of `headPointer` and `tailPointer` after **one** item is removed. [2]

(b) "D" is then added. State `tailPointer` afterwards, and explain why no further items can be added even though indexes 0 and 1 are empty. [3]

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7

Total: 4 marks

Write the function `enqueue(item)` for this linear queue (`theQueue`, `headPointer`, `tailPointer`, `maxSize` are global). Return `False` if there is no space at the end; otherwise add the item, update the tail pointer and return `True`. [4]

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8

Total: 4 marks

Write the function `dequeue()` for the same queue. If the queue is empty it returns the string `"EMPTY"`. Otherwise it returns the item at the front and updates the head pointer. [4]

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9

Total: 6 marks

A student wrote the function below to enqueue an item. It should return `False` if the queue is full and `True` once the item has been added. It contains **three** errors.

```
01 function enqueue(item)
02   if tailPointer == maxSize then
03     return True
04   else
05     theQueue[headPointer] = item
06     tailPointer = tailPointer - 1
07     return True
08   endif
09 endfunction
```

Identify the line number of each error and state the correction required. **[6]**

10

Total: 3 marks

Explain the difference between a linear queue and a circular queue, and give one advantage of a circular queue. **[3]**

11

Total: 3 marks

A queue stores the ID numbers of print jobs. Some jobs are given a priority and must be processed first.

Explain why a standard (FIFO) queue is **not** suitable for this program, and name a data structure that would be more suitable. **[3]**

12 *

Total: 8 marks

A printer manages waiting jobs using the queue. The main program repeatedly asks the user whether they want to add a job, remove a job, or quit:

- If **add**: input a job name and call `enqueue(jobName)`. If it returns `False` output "Queue is full", otherwise "Job added".
- If **remove**: call `dequeue()`. If it returns "EMPTY" output "Queue is empty", otherwise output the job name removed.
- The loop continues until the user enters "quit".

Write the main program. [8]

END OF WORKSHEET · 56 MARKS