3 **(a)** Draw **one** line to connect each **Operating System (OS)** term to the **most appropriate** description about it.

OS term	Description
Multi-tasking	Using secondary storage to simulate additional main memory
Paging	Managing the processes running on the CPU
Interrupt handling	Managing the execution of many programs that appear to run at the same time
Scheduling	Locating non-contiguous blocks of data and relocating them
Virtual memory	Transferring control to another routine when a service is required
	Reading/writing same-size blocks of data from/to secondary storage when required

[5]

(b) Explain how an interpreter executes a program without producing a complete translated version of it.

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..... [4]

4 **(a)** **(i)** Explain why Reverse Polish Notation (RPN) is used to carry out the evaluation of expressions.

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.....

..... [2]

(ii) Identify, with reasons, a data structure that could be used to evaluate an expression in RPN.

.....

.....

.....

..... [2]

(b) Write the infix expression in RPN.

```
(a - b) * (a + c) / 7
```

.....

..... [1]

(c) Write the RPN expression as an infix expression.

```
a b / 4 * a b + -
```

.....

..... [1]

(d) Evaluate the RPN expression:

```
a b + c d / /
```

where `a = 17, b = 3, c = 48 and d = 12.`

Show your working.

.....

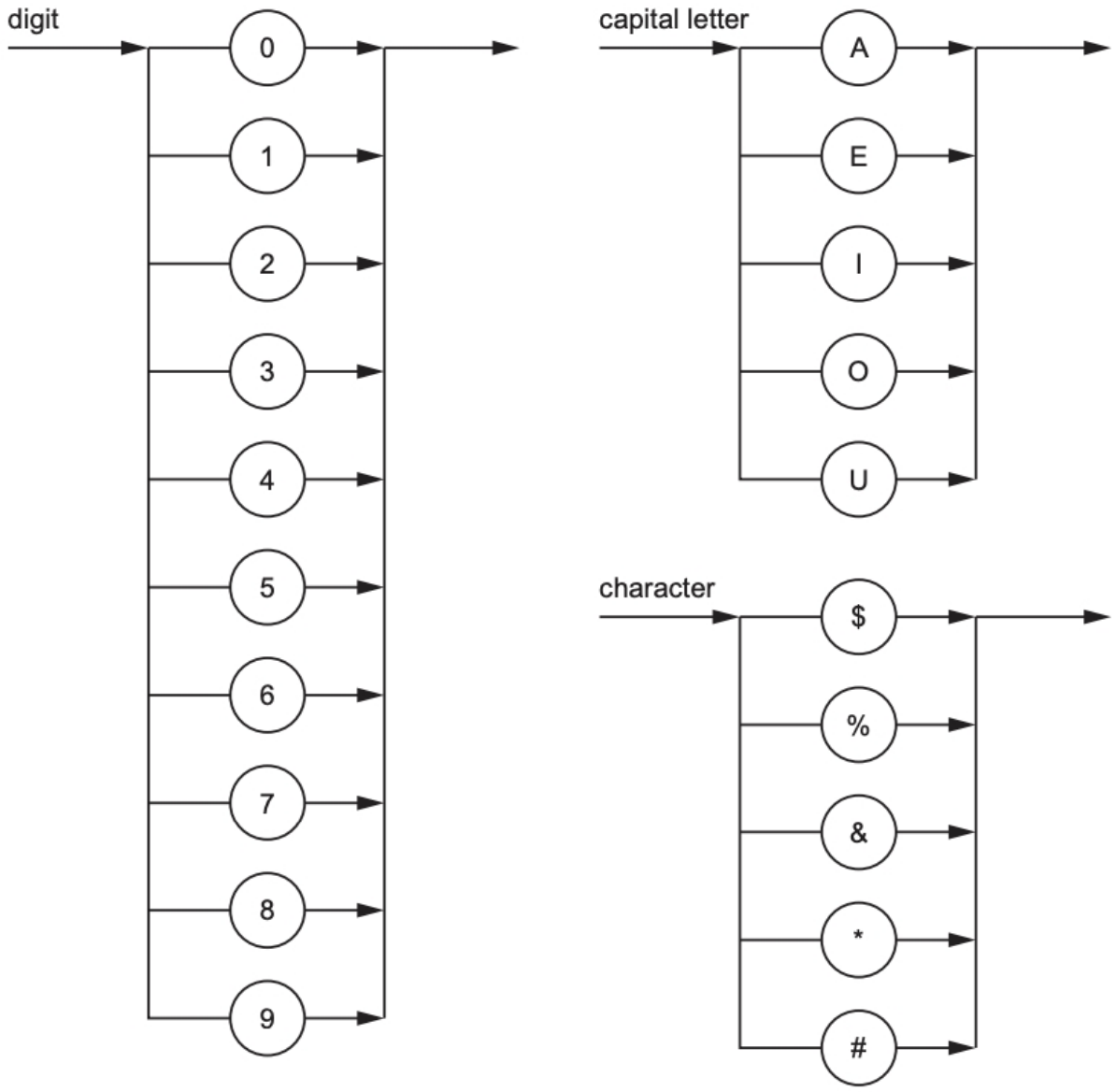
.....

.....

..... [2]

4 The following syntax diagrams for a particular programming language show the syntax of:

- a digit
- a capital letter
- a character.



(a) Write the Backus-Naur Form (BNF) notation of the syntax diagram for character.

.....

.....

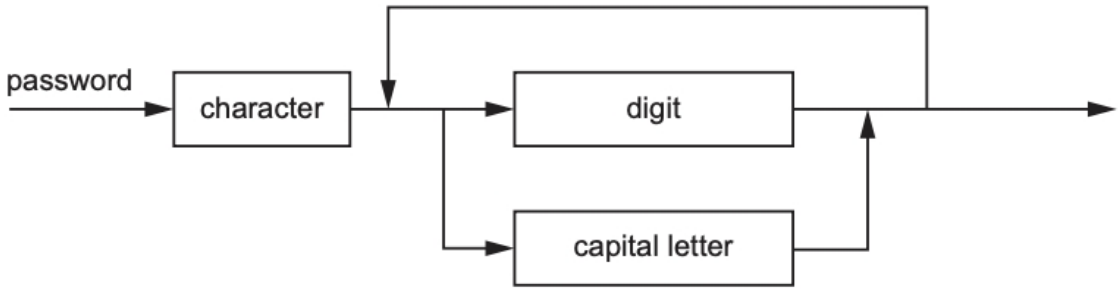
..... [2]

(b) A password must begin with a character and be followed by one or more digits or capital letters.

(i) State an example of a valid password.

..... [1]

(ii) A valid password is represented by the syntax diagram:



Write the BNF notation of the syntax diagram for password.

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..... [4]

5 Part of a program's calculations uses the integer variables `j`, `k`, `m`, `n` and `p`.

```
j = 3
k = 2
m = 10
n = (j + k)/(j - k)
p = m * (m - j * k)
```

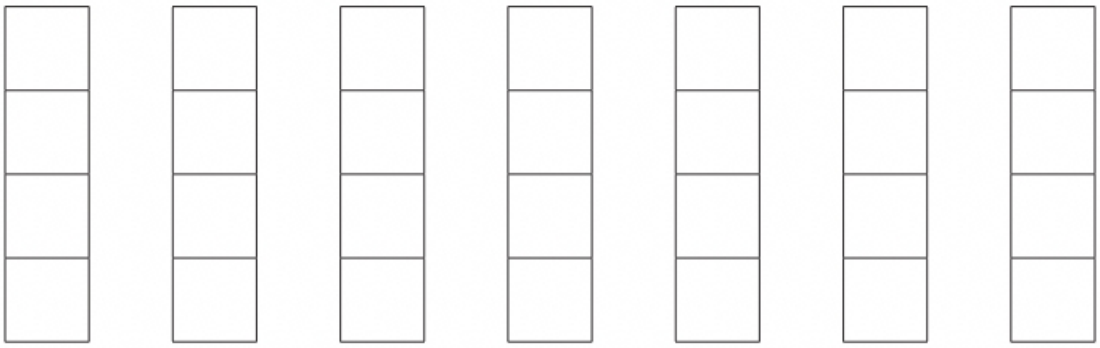
(a) Write the Reverse Polish Notation (RPN) for the expression:

```
(j + k)/(j - k)
```

..... [2]

(b) **(i)** Show the changing contents of the stack as the value for `p` is calculated from its RPN expression:

```
m m j k * - *
```



[4]

(ii) Describe the main steps in the evaluation of this RPN expression using a stack.

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..... [4]

(c) State **two other** uses of a stack.

1 .....

.....

2 .....

.....

[2]

4 Draw **one** line to connect each stage of compilation to its **most appropriate** description.

Stage of compilation	**Description**
Lexical analysis	minimising a program's execution time and memory requirement
Syntax analysis	converting an intermediate representation of source code into an executable form
Code generation	converting a sequence of characters into a sequence of tokens
Optimisation	directly executing instructions written in a scripting language
	using parsing algorithms to interpret the meaning of a sequence of tokens

[4]

5 **(a)** Write the infix expression in Reverse Polish Notation (RPN).

```
a * b + b - d + 15
```

.....

..... [1]

(b) **(i)** Write the RPN expression in infix form.

```
a b - c d + * a /
```

.....

..... [1]

(ii) Evaluate your infix expression from **part (b)(i)** when a = 5, b = 10, c = 27 and d = 12.

.....

..... [1]