4 **(a)** A scheduling routine determines how processes are managed by the operating system.

Identify **two** scheduling routines.

1 .....

2 .....

[2]

(b) Describe **two** ways in which the complexities of the computer hardware are hidden from the user.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

8 **(a)** Outline the purpose of lexical analysis during the compilation of a program.

.....

.....

.....

..... [2]

(b) Write the Reverse Polish Notation (RPN) for the given infix expression:

```
(2 - 6) * (13 + 7) / 5
```

.....

.....

.....

..... [2]

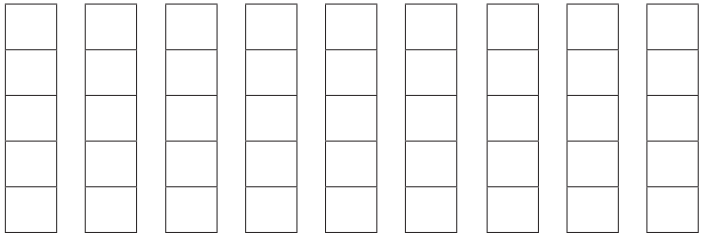
(c) The RPN expression:

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

is to be evaluated, where:

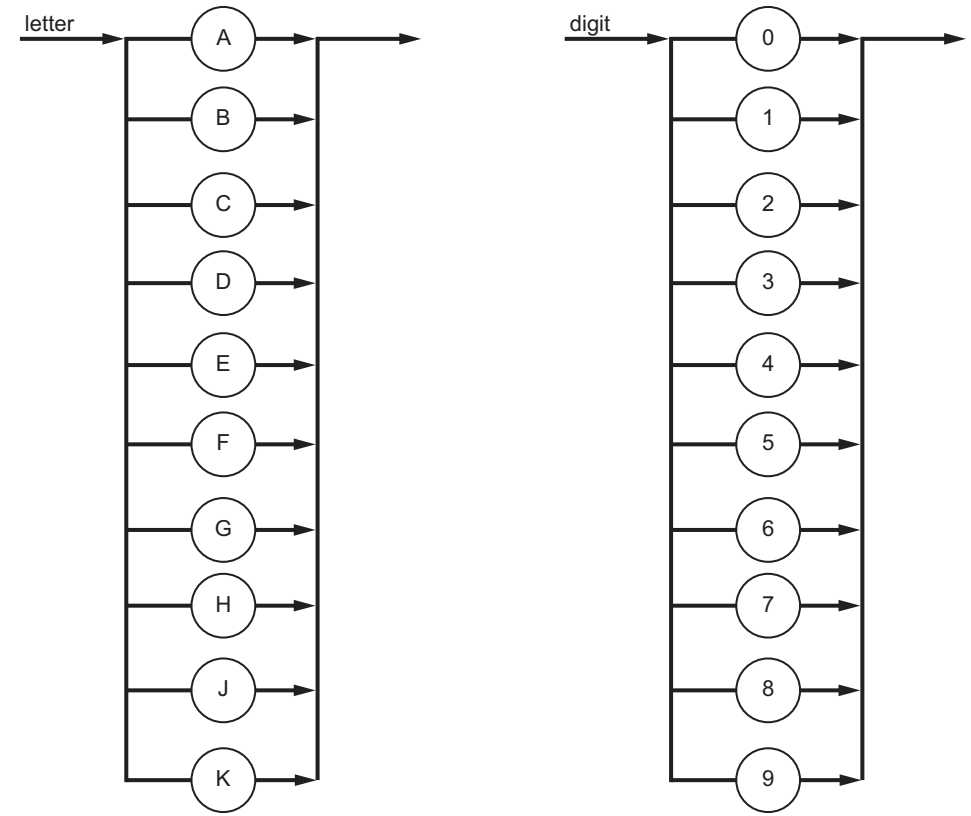
`a = 6`, `b = 12`, `c = 15` and `d = 5`.

Show the changing contents of the stack as the RPN expression is evaluated.



[4]

9 Several syntax diagrams are shown.



(a) State why `9K` is **not** a valid variable for the given syntax diagrams.

.....

..... [1]

(b) Complete the Backus-Naur Form (BNF) for `<operator>`.

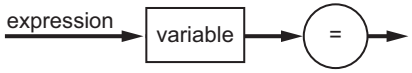
`<operator> ::=` .....

..... [1]

(c) An expression is defined as follows:

- A variable is assigned to a variable followed by an operator followed by another variable.
- The operator and final variable stage can be repeated as many times as necessary.

Complete the syntax diagram for an expression.



[3]

(d) A character can be a letter or a digit.

An additional constraint has been applied to the definition of variable. It must comply with the given syntax diagram, but it will only pass validation if it has at least **four** characters.

State **one** example of a valid variable.

.....

..... [1]

10 Identify the **two** main protocols that form Transport Layer Security (TLS) **and** state the purpose of each.

Protocol 1 .....

Purpose .....

.....

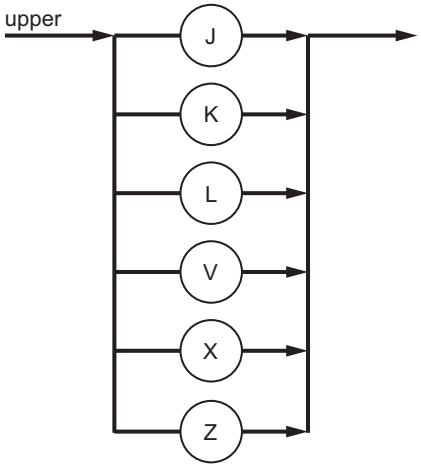
Protocol 2 .....

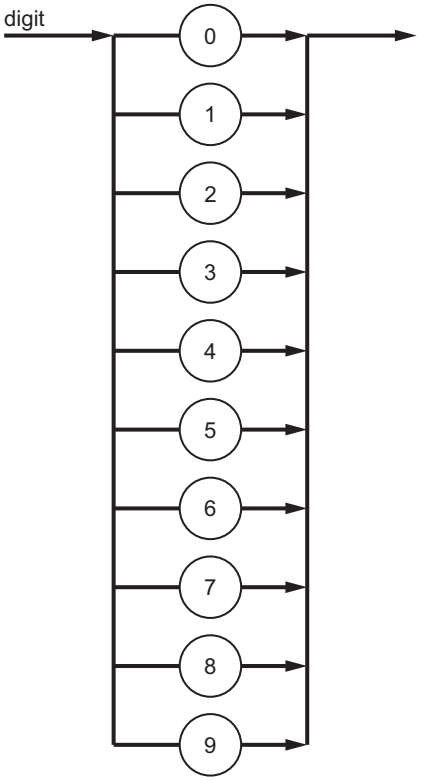
Purpose .....

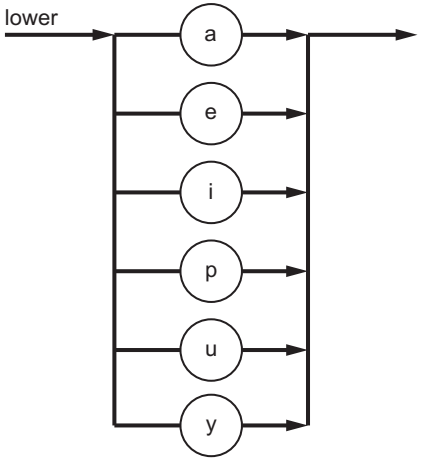
.....

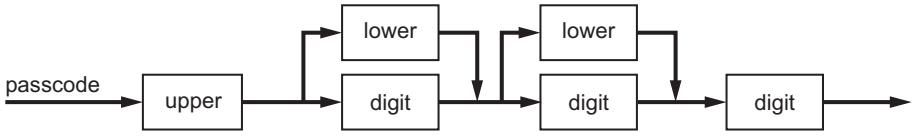
[4]

9 Several syntax diagrams are shown.









(a) State why `JJ90` is **not** a valid passcode for the given syntax diagrams.

.....

..... [1]

(b) Complete the Backus-Naur Form (BNF) for `<upper>` and `<passcode>`.

`<upper> ::=` .....

.....

`<passcode> ::=` .....

.....

.....

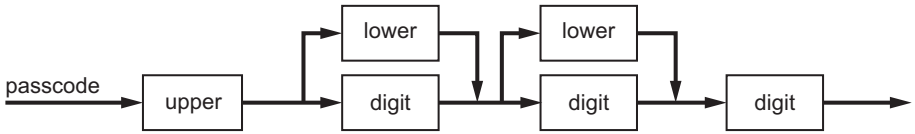
.....

[3]

(c) A character can be an upper, a lower or a digit.

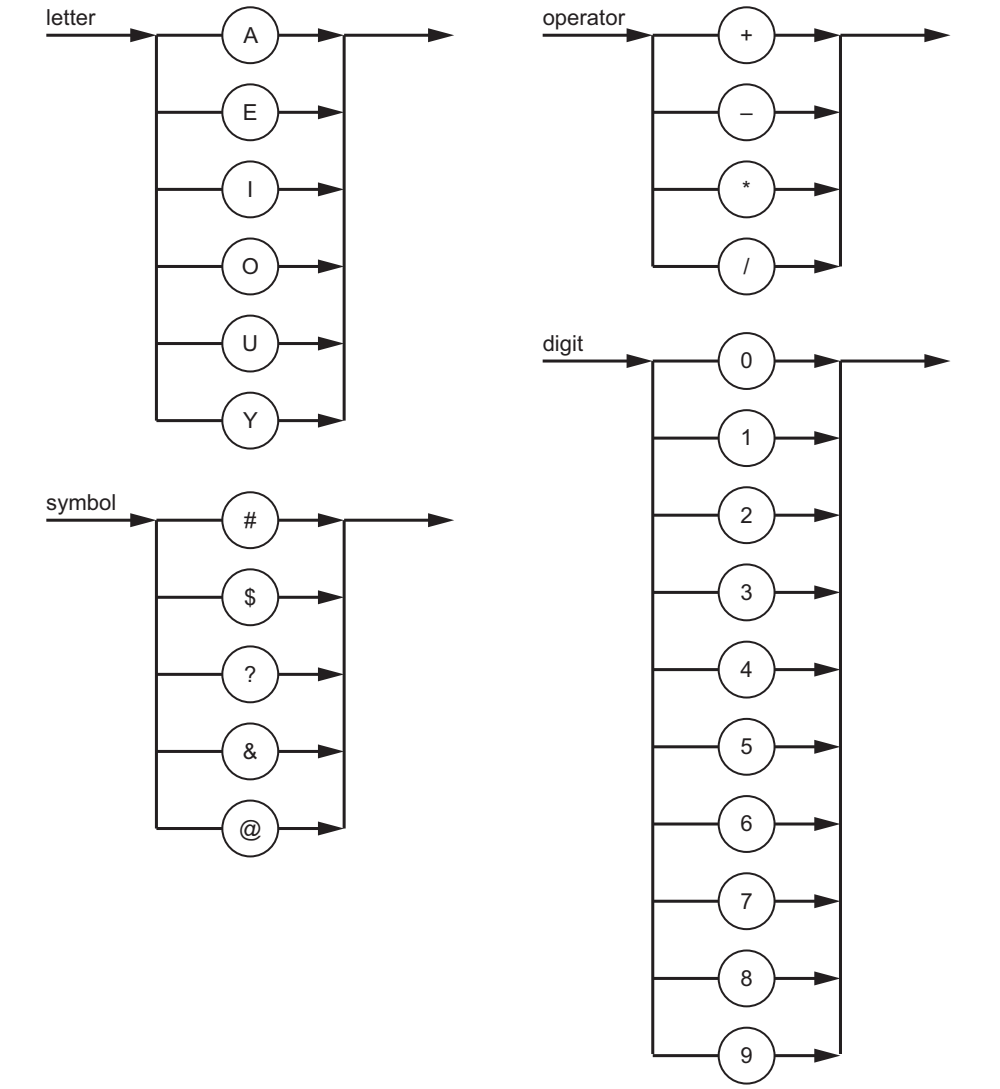
The rules for passcode have been changed so that the third character may also be selected from upper and the final character may be repeated one or more times.

Complete the syntax diagram for passcode to show these changes.



[2]

10 Several syntax diagrams are shown.



(a) Complete the Backus-Naur Form (BNF) for the given syntax diagrams.

<operator> ::= .....

.....

<label> ::= .....

.....

<equation> ::= .....

.....

[4]

(b) A new syntax rule, **password**, is required. It must begin with a letter or a symbol, followed by a digit and end with one or two symbols.

(i) Draw a syntax diagram for **password**.

[3]

(ii) Write the BNF for **password**.

.....

.....

.....

..... [2]