Ch20

System Software (A Level)

CHAPTER ASSIGNMENT · 64 MARKS

Name _____ Class _____ No. _____ Date _____

> Answer every question in the space given. Show your working. You may use the chapter page to help you.

Questions from *Computer Science for Cambridge International AS & A Level Coursebook*, 2nd edition, Sylvia Langfield and Dave Duddell (Cambridge University Press), for classroom use.

Tasks and questions from the chapter

DP **Discussion Point:** What would happen if an interrupt was received while the interrupt-handling routine was being executed by the CPU? Does this require a priority being set for each interrupt?

EQ20.01 **Extension Question 20.01:** Find out information about the virtual memory capacity and page size of a computer system that you use. In what circumstances might these need to be changed?

Q20.01 A symbol table is used by an assembler and by a compiler or interpreter. What are the differences between these?

Q20.02 Can you think of any reason why a compiler might wish to tokenise white space rather than removing it all?

Q20.03 Check the maths for the efficient code defined above:

```
x := (a + b) * (a - b)
y := (a + 2 * b) * (a - b)
```

The most efficient code would be:

```
temp := (a - b)
x := (a + b) * temp
y := x + temp * b
```

20.01 Practise your understanding of RPN.

(1) Convert the following infix expressions into RPN using the methods described in Worked Examples 20.01, 20.02 and 20.03:

- `(x - y) / 4`
- `3 * (2 + x / 7)`

(2) Convert the following RPN expressions into the corresponding infix expressions:

- `4 a b + c + d + e + *`
- `y 2 ^ z 3 ^ + 6 /`

Note that the caret (`^`) symbol represents 'to the power of'.

(3) Using simple values for each variable in part 2, use the infix version to evaluate the expression. Then use the stack method to evaluate the RPN expression and check that you get the same result.

RP **Reflection Point:** Have you learned that two data structures illustrated here, the binary tree and the stack, have many different uses in computer science?

Exam-style questions

1

(a) In a multiprogramming environment, the concept of a process has been found to be very useful in controlling the execution of programs.

(i) Explain the concept of a process. [2]

(ii) In one model for the execution of a program, there are five defined process states. Identify **three** of them and explain the meaning of each. [6]

(b) The transition of processes between states is controlled by a scheduler.

(i) Identify **two** scheduling algorithms and for each classify its type. [4]

(ii) A scheduling algorithm might be chosen to use prioritisation. Identify **two** criteria that could be used to assign a priority to a process. [2]

2

(a) Three memory management techniques are partitioning, scheduling and paging.

(i) Give definitions of them. [3]

(ii) Identify **two** ways in which they might be combined. [2]

(b) Some systems use virtual memory.

(i) Identify which of the techniques in **part a** is used to create virtual memory. [1]

(ii) Explain **two** advantages of using virtual memory. [4]

(iii) Explain **one** problem that can occur in a virtual memory system. [2]

3

(a) A compiler is used to translate a program into machine code.

(i) A compiler is modelled as containing a front end and a back end. State the overall aim of the front end and of the back end. [2]

(ii) Identify **two** processes which are part of the front end. [2]

(iii) Identify **two** processes which are part of the back end. [2]

(b) Complete the following Backus–Naur definition of a signed integer: [4]

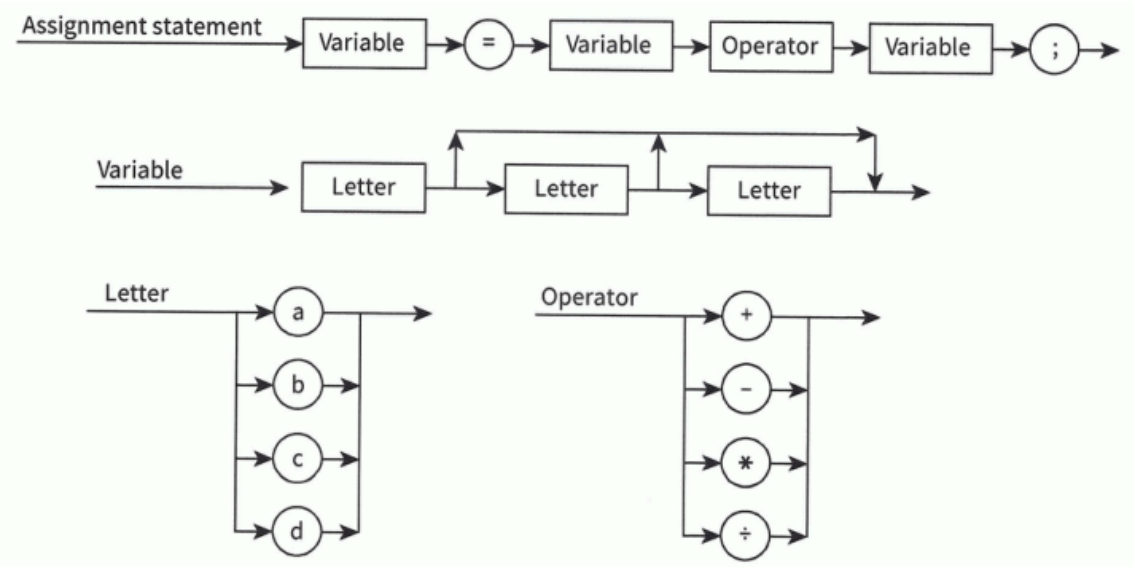
- i: `<Digit> ::=`
- ii: `<Sign> ::=`
- iii: `<Unsigned integer> ::=`
- iv: `<Signed integer> ::=`

(c) Give the Reverse Polish notation equivalent of the expression `(a + 6) + b / c`. [2]

(d) Give the infix notation equivalent of the Reverse Polish expression `a 3 b * 6 c * - +`. [2]

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

- an assignment statement
- a variable
- a letter
- an operator



(a) The following assignment statements are invalid.
Give the reason in each case.

(i) `a = b + c` [1]

(ii) `a = b - 2;` [1]

(iii) `a = dd * cce;` [1]

(b) Write the Backus-Naur Form (BNF) for the syntax diagrams shown above. [6]

- i: `<assignmentstatement> ::=`
- ii: `<variable> ::=`
- iii: `<letter> ::=`
- iv: `<operator> ::=`

(c) Rewrite the BNF rule for a variable so that it can be any number of letters. [2]

`<variable> ::=`

(d) Programmers working for a software development company use both interpreters and compilers.

(i) The programmers prefer to debug their programs using an interpreter.
Give **one** possible reason why. [1]

(ii) The company sells compiled versions of its programs.
Give a reason why this helps to protect the security of the source code. [1]

Cambridge International AS & A Level Computer Science 9608 Paper 31 Q1 June 2015

5 A number of processes are being executed in a computer.

(a) Explain the difference between a program and a process. [2]
A process can be in one of three states: running, ready or blocked.

(b) For each of the following, the process is moved from the first state to the second state. Describe the conditions that cause each of the following changes of the state of a process: [6]

- i: From running to ready
- ii: From ready to running
- iii: From running to blocked

(c) Explain why a process cannot be moved from the blocked state to the running state. [3]

(d) Explain the role of the high-level scheduler in a multiprogramming operating system. [2]

Cambridge International AS & A Level Computer Science 9608 Paper 31 Q6 November 2015

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/computer-science/as-a-level/system-software-a-level/