

E1027 Software Engineering & Computer Programming:
Exam Paper, May 1999

SECTION A (Compulsory)

- (1) There follows a description of the book reservation system for the SEECS library:

The SEECS Library System allows the librarian to select information about a particular book, including its title, author, and contents summary and whether it is a short-loan or normal-loan book. The librarian can also examine the status of the book (available or on loan) and change this status if required.

Students come to the library to request one or more books. They may also ask the librarian to check by specification, that is, “what books have ‘Java’ in their title?” or “When will the ‘Database Systems’ book be available?” (which could be available right now or at a later date). For each book checked out, the loan details that are recorded include the name of the student, the book taken, the loan date and the return date.

The system should maintain a complete list of book loans. A very useful function for the librarian would be to get a report on those books on loan that are overdue.

- (a) Apply the ‘noun and verb approach’ to generate a first attempt at identifying nouns and verbs related to the software solution of the problem (i.e. produce two lists, one with the nouns and the other with the verbs). **[5 marks]**
- (b) Generate a table of candidate Java classes with their complete sets of attributes and methods. Briefly justify your choice of the Java classes you have identified. **[8 marks]**
- (c) Use a diagram to show how you would structure your Java code to provide the solution to the above problem. You should indicate how many files you would use, what their content would be, and how they would all be connected together. In each file you should include the most important Java declarations that demonstrate how the file would be used, e.g. class definitions, import statements, key class methods and variables. You are not required to write any other Java code or pseudo code. **[7 marks]**
- (2) (a) In the Object-oriented approach to complex systems development, the conceptual framework is the ‘object model’. There are FOUR major elements without any one of which the solution is not Object-oriented. Identify these four major elements of the model and give your definition and examples of each element that demonstrate the function of each element. Use the information from your answer to demonstrate how the Object-oriented approach overcomes the problems identified by the following statement:

“The problem with most industrial strength applications is that it is impossible to comprehend all of the subtleties of its design”. [10 marks]

- (b) An object has STATE, BEHAVIOUR, and IDENTITY. The state of an object encompasses all of the (usually static) properties of the object plus the current (usually dynamic) values of each of these properties. Behaviour is how an object acts and reacts to its state changes and message passing functions. Identify is the property of an object that distinguishes it from all other objects.

Using the above information as a basis for developing of an Object-oriented solution to a problem of your choosing (e.g. a drinks vending machine or ATM cash machine), identify the relevant features of your problem domain and show how their characteristics are mapped onto these three areas. [10 marks]

SECTION B (Answer 12 out of 20 questions; each question is worth 5 marks)

- (1) If the CD class has already been defined, show how you can create a CD Collection array which will be used to store information on 100 CD objects.
- (2) What are a ‘Label’ and a ‘TextField’? Give examples of how you would use both of these GUI components.
- (3) Correct the syntax in the following piece of code (assume that BasicIo is available):

```
int myGuess = '21';
int yourGuess = BasicIo_readInteger()
if (myGuess = yourGuess) then
    System.out.println('You have guessed my number!');
```

- (4) Describe the process of creating an array in Java.
- (5) If int yearOfStudy holds the year a student is in, use a switch statement to do the following:

```
if yearOfStudy is 1 then display “First year student”
if yearOfStudy is 2 then display “Second year student”
if yearOfStudy is 3 then display “Final year student”
if yearOfStudy has any other value then display “Unknown year of study”
```

- (6) When, in Java, is the array allocated memory for storage of its contents?
- (7) Using a while loop and the BasicIo class, write some code which asks the user to enter either the number ‘0’ or ‘1’ as a reply. The code should not accept any other value as being correct.

- (8) Describe the differences between a grid layout manager and a flow layout manager.
- (9) Explain what the difference is between the two versions of the matchesPlayed variable:

```
public class FootballTeam{  
    public int matchesPlayed;  
}
```

```
public class FootballTeam{  
    public static int matchesPlayed;  
}
```

- (10) When using GUI development tools Java uses a co-ordinate system. Describe how this co-ordinate system is used.
- (11) Create a method called sevenUp which accepts an integer as a parameter and returns a new integer which equals the parameter integer increased by 7.
- (12) Describe the mechanism that Java uses to deal with Multiple Exceptions?
- (13) dailyTemperature has been declared as an array which can hold 31 integer temperatures. Use a single loop to set the first 15 temperatures to 25 and the rest to 30.
- (14) Explain what may occur to a thread that is in the running state. For TWO states that a thread may enter, describe how the thread may return to the runnable state.
- (15) Write some Java code which, with the help of the BasicIo class, prompts the user to enter their last name and then performs two tests:

```
if the name length is more than 15 letters, it displays "You must be Spanish!"  
if the name is "Bond", it displays "James, is that you?"
```

- (16) Explain how the separation of the GUI portion of an application leads to flexible programmes.
- (17) Write the HelloWorld program, which displays the message "Hello World!" on the screen.
- (18) Explain the concept of 'array bound checking' in Java.

(19) Given the following class definition:

```
public class shape{  
    public int sides;  
}
```

show the contents of the computer memory after the following statements have been executed, assuming that memory space was previously completely empty

```
triangle = new shape();  
square = new shape();  
square.sides = 6;  
square = triangle;
```

(20) List the missing word(s) in your answer book for the blanks in each of the following statements:

- (a) The process of determining if an array contains a key value is called the array.
- (b) The expression $x == y$ means a test is performed to see whether x is to y.
- (c) The method draws a line between two co-ordinates.
- (d) GUI is an acronym for
- (e) Naming an array, stating its type, and specifying the number of elements in the array is called the array.
- (f) is the default layout manager for a panel.
- (g) The keyword introduces a class definition.
- (h) The keyword is used in a method handler to indicate that a method does not return a value.
- (i) Members of a class specified as are accessible only to methods of that class.
- (j) The return type of getName is always a

(Questions done: 1, 3, 4, 5, 7, 9, 11, 13, 15, 17, 18, 20)