University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

SEMESTER I EXAMINATION – 2013/2014

COMP 20080

Computer Science for Engineers II

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Time allowed: 2 hours

Instructions for candidates

Answer ALL questions. Question 1 is worth 40 marks. All other questions are worth 3 marks each.

Write your answers in the Answer Books provided.

Instructions for invigilators

Loose Rough Work sheets are not to be distributed or used.

Use of calculators is prohibited.

1. ***[40 marks]***

Consider the following contained in a C++ file **`Employee.h`**:

```
#define basic_salary 500
class Employee
{
   private:
   int id; // employee's identifier
   int sal; // employee's salary

   public:
   Employee(int eid); // constructor
   int get_employee_id();
   void print_details();
};
```

(a) Implement the above methods in another C++ file **`Employee.cpp`** according to the following specifications:

i. The constructor **`Employee(int eid)`** sets up an object of the class **`Employee`** with identifier **`eid`** and salary **`basic_salary`** **[4 marks]**

ii. The method **`get_employee_id()`** returns the value of the employee's identifier. **[4 marks]**

iii. The method **`print_details()`** prints to the screen the employee's identifier and salary. **[4 marks]**

(b) An ***hourly-paid employee*** is a special kind of employee, who has an additional attribute for the number of hours worked (you may assume that the hourly rate of pay is fixed to EUR 10 per hour). A method must be provided to allow external code to set the number of hours an hourly-paid employee works; and an hourly-paid employee's **`print_details()`** method prints to the screen the employee's identifier, number of hours worked, and salary (which is the sum of the **`basic_salary`** and an amount depending on number of hours worked). The number of hours worked is always a non-negative integer.

Write the appropriate header file **`Hourly_Paid_Employee.h`** which is derived from the **`Employee`** class in part (a) according to these specifications. **[8 marks]**

(c) Implement the methods in **`Hourly_Paid_Employee.h`** in another C++ file called **`Hourly_Paid_Employee.cpp`** **[10 marks]**

(d) Write a C++ program which declares an object of the **`Employee`** class and an object of the **`Hourly_Paid_employee`** class, gets the number of hours the hourly-paid employee worked and both employees' identifiers from keyboard input, and prints both objects' details to the screen. **[10 marks]**

Questions 2–21 are worth 3 marks each

2. Which of the following statements are true about an **Abstract Data Type** (ADT)? *(choose all that apply)*

(a) An ADT consists of a data structure, and functions that access and modify that structure.

(b) The ADT concept is a core element of the functional abstraction approach.

(c) When implemented in C++, each ADT used in an application is usually written in a separate source file.

(d) When implemented in C++, all ADTs used in an application must be written in a single source file.

3. **True** or **False** *(no explanation required)* – a C++ programmer can specify multiple constructors for a class they define.

4. In C++, a **method**: *(choose all that apply)*

(a) is a function which is declared within a `class` statement

(b) cannot be called directly from external code (i.e. outside the class in which the method is defined)

(c) has direct access to the private data fields of its associated class

(d) cannot be used in a derived class unless it is overridden by code in the derived class

5. **True** or **False** *(no explanation required)* – for a C++ class, ***operator overloading*** means operators such as **+** or ***** are used in the code for multiple methods of the class.

6. The **substitution principle** as applied to C++ states: *(choose **the** correct answer)*

(a) any code which manipulates an object of a base class will work correctly if it is supplied with an object of another class immediately preceded by the name of this base class and **:**

(b) any code which manipulates an object of a derived class will work correctly if it is supplied with an object of the corresponding base class.

(c) any code which manipulates an object of a base class will work correctly if it is supplied with an object of any derived class of this base class.

7. Well-engineered software should possess these attributes: *(choose all that apply)*

(a) transparency

(b) maintainability

(c) usability

(d) lower cost than any competing software system

8. A **software process model** specifies: *(choose all that apply)*

(a) the activities that should be done in each phase of software development

(b) the programming language(s) that should be used in software development

(c) the criteria in each phase that should be met in order to proceed to the next phase of software development

(d) the personnel who should be involved in each phase of software development

9. **True** or **False** *(no explanation required)* – software ***verification*** involves ensuring that the software conforms to its specifications.

10. Which of the following statements are true about a **sequence model** that is produced as part of an objected-oriented design approach? *(choose all that apply)*

(a) Interactions between the objects involved in a particular usage scenario are represented by labelled arrows.

(b) Usually, only the major usage scenarios are represented by sequence models.

(c) The arrows between objects involved in a particular usage scenario may not represent data transfers between those objects.

11. Which of the following are typical major phases in **compiling** a source program into machine code? *(choose all that apply)*

(a) character identification

(b) syntax analysis

(c) intermediate data generation

(d) code generation

12. **True** or **False** *(no explanation required)* – the BIOS program on a personal computer is stored in RAM so that the operating system can load it when the computer boots up.

13. Which of the following are typically found in the CPU of a computer? *(choose all that apply)*

(a) Instruction Register

(b) Arithmetic and Logic Unit

(c) Network Card

(d) Program Counter

14. A ***private*** data field of a C++ class can be accessed by *(choose **the** correct answer)*

(a) any statement in any C++ program, if the class header file is included.

(b) any statement in any C++ program, if the data field name is immediately preceded by **`private:`**

(c) any statement in any of the methods associated with the class.

15. Which of the following are commonly used **compiler optimisation techniques**? *(choose all that apply)*

(a) elimination of common sub-expressions

(b) use variable names instead of constant values

(c) move loop invariants outside their loops

(d) put multiple code statements on the same line of the program

16. Which of the following are layers in the ISO Reference Model for Open System Interconnection (OSI)? *(choose all that apply)*

(a) Presentation layer

(b) Network layer

(c) Radio layer

(d) Internet layer

17. In **datagram packet switching**, which of the following are essential: *(choose all that apply)*

(a) a path is set up in the network between the sender and the receiver

(b) each packet contains the address of the receiver

(c) each packet contains a sequence number to indicate how it is related to other packets being sent from the same sender to the same receiver

(d) none of the above

18. **True** or **False** *(no explanation required)* – both Time Division Multiplexing and Frequency Division Multiplexing divide a shared communications link into **independent** channels.

19. The essential difference between a **program** and a **process** is: *(choose **the** correct answer)*

(a) A program is a set of instructions and data, whereas a process is just the set of instructions

(b) A program is a set of instructions and data, whereas a process is an executing program

(c) There is no difference – both program and process refer to the same thing

20. The three process states are **ready**, **running**, and which one of the following: *(choose **the** correct answer)*

(a) paused

(b) sleeping

(c) blocked

21. **True** or **False** *(no explanation required)* – in C++, after a called function returns control to its calling function, the called function's variables are not accessible to the calling function.