

**Athlone Institute of Technology**  
**Faculty of Engineering & Informatics**  
**Semester 1 Examinations 2018**  
**December Session**



**Bachelor of Science (Hons) in Software Design (Game Development)**

**Year 3**

**Software Development for Gaming 3**

**External Examiner(s):      Mr Jerh O'Connor & Dr Steven Davy**

**Internal Examiner(s):      Mr John Barrett**

**Instructions to Candidates:** *(make sure you have received the **correct** exam paper)*

**Read all questions carefully.**

**All questions carry equal marks.**

**Answer THREE out of FOUR Questions.**

**Time allowed: 2 Hours**

**No. of pages (including cover sheet, attachments/drawings): 5**

Q.1. (a) Compare the Standard Template Library list container and the Standard Template Library vector container in terms of efficiency when:

- Adding/Removing the element in the middle of the container.

(4 Marks)

- Adding/Removing the element at the end of the container.

(4 Marks)

(b) Bank of Europe has a customer base of over 100 million clients. Due to the large number of clients it needs to store client information in a linked list data structure. A client has an account number and a name.

- Provide a class `Client` with which instances can be linked forward and backwards to other instances of `Client`.

(6 marks)

- Implement a method which adds an instance of `Client` to a linked list of `Client`.

(6 marks)

**[20 Marks]**

- Q.2. (a) Explain inheritance in relation to C++. (2 Marks)
- (b) Describe the difference between Public, Private and Protected inheritance? (3 Marks)
- (c) Explain, using an example, Polymorphism in C++. (5 Marks)
- (d) Create a UML diagram for the design of a Game Engine for the following game description. You should also provide a brief description of the engine with your answer.

You have been tasked with creating a First-Person Shooter (FPS) where the goal is to eliminate all other Non-Player Characters (NPCs) in an arena. The arena also contains 'friendly' characters. If a 'friendly' is killed the player is eliminated. The game should have the following features:

- Heads Up Display (HUD)
- Inventory System
  - Health pick-ups
  - Armour
  - Weapons
- Player Stats
  - Health
  - Armour
- Non-Player Characters
  - Enemies
  - Friendly

(10 marks)

**[20 Marks]**

Q.3. (a) Memory in C++ is divided into four categories. List and describe each of the four categories.

(8 Marks)

(b) Describe the different named variables in the following program and explain in what category of memory each variable resides. If the variable is a pointer detail what memory it points to.

```
int clearBuffer(char *buffer)
{
    static int functionCount = 0;
    functionCount++;

    int charactersCleared = 0;

    while(buffer[charactersCleared] != '\0')
    {
        buffer[charactersCleared++] = ' ';
    }
    return ++charactersCleared;
}

int main()
{
    int cleared;
    char *buffer = new char[50];
    buffer[49] = '\0';
    cleared = clearBuffer(buffer);
    delete buffer;
}
```

(6 Marks)

(c) What is reference counting in relation to C++? In your answer you should give an example of how reference counting is used.

(6 Marks)

**[20 Marks]**

- Q.4. (a) In relation to C++, describe operators and operands. (2 Marks)
- (b) Describe the function of operator overloading in C++? Provide an example of operator overloading in your answer. (4 Marks)
- (c) What does a C++ compiler do when it encounters a function template? (2Marks)
- (d) Write a function template which compares two parameters of the same type. It should return true if they are equal and false if they are not. (3 Marks)
- (e) Write a function template that will print an array of any type. (4 Marks)
- (f) Write a container class that can hold an object of any type. You should provide accessors and modifiers for the contained object. (5 Marks)
- [20 Marks]**