



School of Science & Technology

Department of Computer Science

BSc/MSci Computer Science

BSc/MSci Computer Science with Computer Games Technology

MSci Computer Science with Cyber Security

MSci Data Science

IN2029: Programming in C++

Stage 2 Examination

January 2025

Examination duration: **90 minutes**

Division of marks: Full marks may be obtained for correct answers to **both** of the **Two** questions. Each question carries 50 marks

Other instructions:

BEGIN EACH QUESTION ON A FRESH PAGE

Number of answer books to be provided: 1

Calculators permitted: Sharp EL-531TS/ EL-531TH/ EL-531TG or Casio FX-83/85

MS/ES/GT+/GTX ONLY

Examination duration: 90 minutes

Dictionaries permitted: None

Can question paper be removed from the examination room: No

Additional materials: None

External Examiner: Prof. Stuart Anderson

Internal Examiner: Dr Vahid Rafe

1. (a)

- (i) Write a function that takes a list of `ints` and then modifies it by incrementing each element by one.

[5 Marks]

- (ii) Write a function that takes a list of `ints` and then returns the smallest value in the list.

[5 Marks]

(b) Using the following library algorithms:

count_if(b, e, p) returns the number of elements in the range $[b, e)$ for which p is true.

find_if(b, e, p) searches the range $[b, e)$ and returns an iterator pointing at the first value for which p is true, if there is one, or e if there is not.

(The notation $[b, e)$ denotes a range starting at the position of the iterator b and extending up to but not including the position of the iterator e .)

- (i) Write a function that takes a list of `ints` and replaces the first odd number (if any) by 1.

[10 Marks]

- (ii) Write a function that takes a list of `ints` and returns the number of odd numbers after the first even number in the list. If the list contains no even number, the function should return 0.

[10 Marks]

(c) Consider the following `multimedia` class:

```
class multimedia {
    const string _title;
public:
    multimedia (const string &s): _title(s) {}
    const string & description() const {
        return _title; }
    virtual void play() const = 0;
};
```

- (i) Write a derived class `music` of `multimedia`. When we call the member function `play()` the following message should be displayed "This is music: " following by its title. You need to write a constructor as well. **[10 Marks]**

Assume there is another derived class `film` of `multimedia`. When we call the member function `play()` the following message is displayed "This is film: " following by its title (You do not need to implement it).

- (ii) Show how you would represent a collection of different `multimedia` objects, how you would add objects of your derived classes to this collection, and how you would call the `play()` member function for each item in the collection. **[10 Marks]**

2. (a) Define a class `vehicle`, with:
- (i) a constructor taking the name of the `vehicle`, its value and its color (the value is an `int` and the other two are `strings`).
[10 Marks]
 - (ii) accessor functions that return the name of the `vehicle`, the value and the color.
[10 Marks]
- (b) Define a class `parking` representing a collection of `vehicles`. Your class should include member functions to:
- [2 Marks]
 - (i) add a new `vehicle`.
[4 Marks]
 - (ii) return the number of `vehicles`.
[4 Marks]
 - (iii) return the total value of all the `vehicles` in the `parking`.
[10 Marks]
 - (iv) using the following library algorithm:
`count_if(b, e, p)` returns the number of elements in the range `[b, e)` for which `p` is true.
return the number of `vehicles` with a given `color`.
[10 Marks]

End of paper