

Université d'Ottawa
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Faculty of Engineering

School of Electrical
Engineering
and Computer Science

CSI2372A Advanced Programming Concepts with C++

MIDTERM EXAMINATION

Length of Examination: 75 minutes

October 10, 2013, 16:00

Professor: Jochen Lang

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Family Name: _____

Other Names: _____

Student Number: _____

Signature _____

You are allowed **ONE TEXTBOOK** as a reference.

No calculators or other electronic devices are allowed.

Please answer the questions in this booklet.
If you do not understand a question, clearly state an assumption and proceed.

At the end of the exam, when time is up:
Stop working and turn your exam upside down.
Remain silent.

Question	Marks	
1.1-1.6		6
2.1		3
2.2		3
2.3		1
4a		5
4b		3
4c		3
4d		2
Total		26

PART 1: SHORT QUESTIONS (6 MARKS)

1. What is the value of a at the end of the following program

```
unsigned int a = 0xFF, b= 0x0F0F;  
a ^= b;
```

2. Given the following declarations

```
class A {};  
class B : protected A {};  
A foo( A a );
```

Find the error below and state why it is an error:

```
B b;  
A* a = new A();  
foo(*a);  
A c = foo(b);  
*a = foo(c);
```

3. What is printed by the following program?

```
union Combi {  
    int i;  
    short s;  
};  
...  
Combi c;  
c.i = 0xFF0001;  
std::cout << c.s;
```

4. What is the value of `a` at the end of this program?

```
int A[][2] = {10,20,30,40};
int (*ptr)[2] = &A[0];
int a = **(++ptr);
```

5. Given the function declarations below which one will be called by the code (or will the call be in error)?

```
void func(int& i);
int func(const float* f);
float func(double* d);

float f=5.0f;
float g = func(&f);
```

6. Given:

```
class B {};
struct A {
    A( B b );
};
```

Call the function `void test(A a, int* b=0);` with the two corresponding variables below.

`B b; int i;`

PART 2: PROGRAMMING QUESTIONS (20 MARKS)

1. Bit manipulation: Give a function that changes the order of the bytes of a 32 bit (4 byte) unsigned integer. (Example: It should change 0xA50F8421 into 0x21840FA5) [3].

```
unsigned int changeByteOrder( unsigned int val32 );
```

2. Implement the following function to convert the ASCII characters in an old style C-string from lower case letters to upper case letters. (Characters which are not lower case should be unchanged). ASCII characters with decimal values 65-90 correspond to A-Z while characters with decimal values 97-122 correspond to a-z [3].

```
void makeUpper( const unsigned char* input, unsigned char* output);
```

3. State what happens if your routine from the above question is called as follows [1]:

```
unsigned char in[] = "university";  
unsigned char* res;  
makeUpper(in, res);
```

4. Consider the below definitions for Room and Event . (Partial class definitions to be extended by you in the following questions).

```
#include <string>

struct Room {
    int d_noSeat;
    bool d_hasProjector;
};

class Event {
    Room* d_room;
    std::string d_name;
public:
    Event() : d_room(0), d_name("") {};
    void set( Room r, const std::string& name );
};
```

- a. Implement any missing functions and constructors for Room and Event for the code below. Do you need to implement a constructor for room? If yes implement it, if no state why? [5]

```
int main() {
    Room r;
    r.d_noSeat = 37; r.d_hasProjector = true;
    Event lectures[25];

    for ( int i=0; i<25; ++i ) {
        lectures[i].set( r, "CSI2372" );
    }
    return 0;
}
```


- b. Implement a shallow copy constructor for `Room`. Your implementation should behave exactly as the synthesized copy constructor by the compiler. Also modify the structure definition.[3]

```
struct Room {  
    int d_noSeat;  
    bool d_hasProjector;  
  
};
```


- c. Implement a deep copy constructor for the class `Event` . Also modify the class definition.[3]

```
class Event {
    Room* d_room;
    std::string d_name;
public:
    Event() : d_room(0), d_name("") {};
```



```
    void set( Room r, const std::string& name );
};
```

d. Implement a destructor for the class `Event`. Also modify the class definition.[2]

```
class Event {
    Room* d_room;
    std::string d_name;
public:
    Event() : d_room(0), d_name("") {}

    void set( Room r, const std::string& name );
};
```