UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION SYSTEMS
FACULTY OF SCIENCE AND ENGINEERING

Assessment Paper

MODULE CODE: CS4013 **MODULE TITLE**: Object Oriented Development

TERM: Autumn Semester, 2008 **EXAM DURATION:** 2.5 hours
VALUE OF EXAM: 40%

LECTURER: Chris Exton

INSTRUCTIONS TO CANDIDATES:
Answer all questions. **(Total 100 marks)**

Please provide SHORT answers to the following question **(use example C++ code as part of your answer)**

Q1 (a) Explain the scope resolution operator. (10 Marks)

Q1 (b) What is a memory leak? (10 Marks)

Q1 (c) What is the Standard Template Library? (10 Marks)

Q1 (d) What is dynamic memory allocation? (10 Marks)

Q1 (e) What is a friend function? (10 Marks)

Q2 (20 Marks)

You compile and execute the following program. What is the EXACT output?

N.B. If you conclude that is does not compile please state this as your answer giving reasons.

N.B. If you conclude that the output is undefined please write "undefined output" where appropriate.

```
#include <iostream>
#include <string>
using namespace std;

class Person;
ostream & operator<< ( ostream & out, const Person & p );

class Person
{
  public:

    Person( int s, const string & n = "" )  : ssn( s ), name( n )
    { cout << "Person Constructed " << *this << endl; }

    virtual ~Person( )
      { cout << endl << "Person Destructed " << name; }

    const string & getName( ) const
      { return name; }

    int getSsn( ) const
      { return ssn; }

    virtual void print( ostream & out = cout ) const
      {
           out << "Person " << ssn << ", " << name;
      }

  private:
    int ssn;
    string name;
};

ostream & operator<< ( ostream & out, const Person & p )
{
    p.print( out );
    return out;
}
```

```
class Student : public Person
{
  public:
    Student( int s, const string & n = "", double g = 0.0 )
      : Person( s, n ), gpa( g )
    {     { cout << "Student Constructed " << n << endl; }   }

    double getGpa( ) const
      { return gpa; }

    void print( ostream & out = cout ) const
      { Person::print( out ); out << ", " << gpa; }

  private:
    double gpa;
};

int main( )
{
    {
    Person  m( 123450000, "Jane");
    Student s( 123456789, "Bob", 4.0 );
    const Person & p = s;
    cout << s << '\n' << p << endl;
    cout << m;
    }

    string ww; // assume a typed input of "exit" followed by enter
    cin >> ww;

    return 0;
}
```

Q3 (10 Marks)

You compile and execute the following program. What is the EXACT output?

N.B. If you conclude that is does not compile please state this as your answer giving reasons.

N.B. If you conclude that the output is undefined please write "undefined output" where appropriate.

```
#include <iostream>
using namespace std;

class C {
public:  C(int i0) : i(i0) { cout << "C: " << i << endl; }
        ~C() { cout << "~C: " << i << endl; }
private: int i;
};

C c1(1); // static

int main()
{
   string inValue;
         cout << "main start" << endl;
         C c2(2); // automatic
         cout << "main middle" << endl;
         C* C3 = new C(3); // dynamic
         cout << "main end" << endl;
}
```

Q4 (10 Marks)

You compile and execute the following program. What is the EXACT output?

N.B. If you conclude that is does not compile please state this as your answer giving reasons.

N.B. If you conclude that the output is undefined please write "undefined output" where appropriate.

```
#include <iostream>
using std::cout;
using std::endl;

void copy1( char *, const char * ); // prototype
void copy2( char *, const char * ); // prototype

int main()
{
  char string1[ 10 ];
  char *string2 = "Hello";
  char string3[ 10 ];
  char string4[] = "Good Bye";

  copy1( string1, string2 );
  cout << "string1 = " << string1 << endl;

  copy2( string3, string4 );
  cout << "string3 = " << string3 << endl;
  return 0;
}

void copy1( char * s1, const char * s2 )
{
  for ( int i = 0; ( s1[ i ] = s2[ i ] ) != '\0'; i++ );
}

void copy2( char *s1, const char *s2 )
{
  for ( ; ( *s1 = *s2 ) != '\0'; s1++, s2++ );
}
```

Q5 (10 Marks)

You compile and execute the following program. What is the EXACT output?

N.B. If you conclude that is does not compile please state this as your answer giving reasons.

N.B. If you conclude that the output is undefined please write "undefined output" where appropriate.

```
#include <iostream>
using std::cout;
using std::endl;

class Count
{
public: // public data is dangerous
  void setX( int value )
  {
    x = value;
  }

  void print()
  {
    cout << x << endl;
  }

private:
  int x;
};

int main()
{
  Count counter;
  Count *counterPtr = &counter;
  Count &counterRef = counter;
  cout << "1: ";
  counter.setX( 1 );
  counter.print();

  cout << "2: ";
  counterRef.setX( 2 );
  counterRef.print();

  cout << "3: ";
  counterPtr->setX( 3 );
  counterPtr->print();
  return 0;
}
```