

**Comilla University**  
**Faculty of Engineering**  
**Department of Computer Science and Engineering**  
**Final Examination - 2014**

Course Code: CSE 213  
 Session: 2012 - 2013

Course Title: Digital Logic Design  
 Semester: 2<sup>nd</sup> Year 1<sup>st</sup> Semester

*[Answer any Five of the following questions. Figures in the right-hand margin indicate full marks.]*

Time: 3 Hours

Full Marks: 60

Writing anything on the question paper is strictly prohibited.

- 1) a) Define a digital computer. Briefly describes about a digital computer with block diagram. 3  
 b) i) Performs  $101110_2 \times 101_2$  ii) Convert  $(4021.2)_3$  to equivalent decimal number. 4  
 c) Differentiate between 1's complement and 2's complement. 1  
 d) Using 2's complement, Subtract  $A - B$  where  $A = 1000100$  &  $B = 1010100$ . 2  
 e) Convert  $(751)_8$  to hexadecimal number. 2
2. a) Add the BCD numbers:  $01001000 + 00110100$ . 2  
 b) Add  $3AF_{16}$  and  $2BA_{16}$ . 2  
 c) Determine the output waveform for the 2-input NAND gate where inputs are random value. 2  
 d) Show that EXOR gate is used for comparison of two numbers. 2  
 e) Apply DeMorgan's theorems for the following expression: 2  

$$\overline{(A + B + C + D)}(ABCD)$$
  
 f) Design and implement a circuit of three variables in which output is high when maximum numbers of inputs are high. 2
- 3) a) Differentiate between minterms and maxterms. Express the Boolean function  $F = xy + x'z$  in product of maxterm form. 2+2  
 b) Draw the logic circuit for the expression  $F = A'B^3 + B(C + D)'$ . 2  
 c) What is parity bit? Prove that  $X + 1 = 1$ . 3  
 d) What is literal? Simplify the following function to 5-literals 3  

$$F = ABC + A'B'C + A'BC + ABC' + A'B'C'$$
4. a) 8421, Excess-3, 84-2-1, 2421 are binary codes for decimal digits. Find that which are weighted codes and which are self-complementary code. 6  
 b) if  $P = \begin{array}{|c|c|c|c|} \hline 0 & 1 & 1 & 0 \\ \hline 0 & 0 & 1 & 1 \\ \hline \end{array}$  4  

$$Q = \begin{array}{|c|c|c|c|} \hline 0 & 1 & 1 & 0 \\ \hline 0 & 0 & 1 & 1 \\ \hline \end{array}$$
  
 Find out i)  $P+Q$  ii)  $Q.P$  iii)  $Q'$  iv)  $P'$   
 c) Differentiate between map method and tabulation method. 2
5. a) What is 3 variable Karnaugh map? Using a K-map, convert the following POS expression into a minimum POS and a minimum SOP expression: 5  

$$(W + \overline{X} + Y + Z)(W + \overline{X} + Y + \overline{Z})(W + X + Y + \overline{Z})(W + X + \overline{Y} + \overline{Z})$$

$$(W + X + Y + \overline{Z})(W + X + \overline{Y} + Z)$$
  
 b) Draw a 3-bit full adder with look-ahead carry generator.

3

c) Develop the logic required to detect the binary code 11010 and produce an active low output. 2 ✓

d) Implement an adder with a 2-line-to-4-line decoder. 2 ✓

6. a) Implement the Boolean function  $F(A, B, C, D) = \sum(1, 3, 5, 6)$  where select  $s_1 = A$  and select  $s_0 = B$ . 3

b) Demultiplexer is also known as a data distributor; explain it. 3

c) Show an octal-to-binary encoder. 2

d) Draw a BCD-to-7-Segment Decoder. 2

e) Write the application of multiplexer in DLD using example. 2

7. a) Differentiate between combinational circuit and sequential circuit? 3

b) Define flip-flop. Explain the clocked JK flip-flop with necessary diagram. 6

c) What do you mean by binary counter? Draw the state diagram of a 3-bit binary counter. 3

8. a) What is bistable logic device? Show the logic symbol of this device. 3

b) A combinational circuit is defined by the functions:

$$F_1(A, B, C) = \sum(3, 5, 6, 7)$$

$$F_2(A, B, C) = \sum(0, 2, 4, 7)$$

Implement the circuit with a PLA having three inputs, four products and two outputs. 3

c) Determine the output waveform if the edge triggered D flipflop starts out RESET when in 1<sup>st</sup> clock D=1, in 2<sup>nd</sup> clock D=1, in 3<sup>rd</sup> clock D=0 and in 4<sup>th</sup> clock D=0. 3

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```

int main()
{
    A a;
    B b;
    cout << "Data: " << func(a,b); return 0;}

```

b. What are the ways, objects can be used with functions? How can object be returned from function? Explain with example.

c. Given the following program

```

#include <iostream.h>
#include <string.h>
#include <stdio.h>
class samp {
    char *str;
public:
    samp() {s = "0";}
    ~samp() {if(s)
        free(s);
    cout << "freeing s\n";
    }
    void show() {cout << s << "\n";}
    void set(char *str);
};
//Load a String
void samp::set(char *str)
{
    S = (char *)malloc (strlen(str)+1);
    if(!s){
        cout << "Allocation error\n";
        exit(1);
    }
    strcpy(s, str);
}
// Return an object of type samp
samp input()
{
    char s[80];
    Samp str;
    cout << "Enter a string";
    cin >> s;
    str.set(s);
    return str;
}
int main()
{
    samp ob;
    //Assign returned object to ob;
    ob = input();
}

```



```
ob.show();  
return 0;
```

What will be the output of the above program? Will there any error be occurred? If occurred, Explain the reasons.

✓ ✓ What is copy constructor? What is the most general form of a copy constructor? Why copy constructors are needed? 3

✓ ✓ Ans: you know, when an object is passed to a function, copy of that object is made. Further when that function returns, the copy's destructor function is called. Keeping this in mind, what is wrong with the following program? 4

```
#include <iostream.h>  
#include <stdlib.h>  
Class dyna{  
    int *p;  
public:  
    dyna(int i);  
    ~dyna(){free(p); cout << "freeing M";}  
    int get() {return *p;}  
};  
Dyna : dyna(int i)  
{  
    p = (int *) malloc(sizeof(int));  
    if(!p){  
        cout << "Allocation failure\n";  
        exit(1);  
    }  
    *p = i;  
}
```

```
//Return negative value of *ob.p  
int neg(dyna ob)  
{  
    Return -ob.get();  
}  
int main()  
{  
    Dyna o1(-10);  
    cout << o1.get() << "\n";  
    cout << neg(o1) << "\n";  
    dyna o2(20);  
    cout << o2.get() << "\n";  
    cout << neg(o2) << "\n";  
    cout << o1.get() << "\n";  
    cout << neg(o1) << "\n";  
    return 0;  
}
```

- c. Explain some ways that ambiguity can be introduced when you are overloading functions. 3
- d. What is *this* pointer? 2

- 5) a. Show the general forms for new and delete. What are some advantages of using them instead of malloc () and free()? 2
- b. What is dynamic memory allocation? Write a program to construct a link list using new. 4
- c. What is reference? What are the differences between reference and pointer? What is one advantage of using a reference parameter? 3
- d. Consider the following C++ code. Generate its output and state the reason of your result. 3

```
#include <iostream.h>
#include <conio.h>
class test {
public:
    test(int i, int j) {
        int sample(int x, int y);
    }
private:
    int a;
    int b;
};
test::test(int i, int j) {
    b = i + j;
}
int test::sample(int x, int y) {
    int c;
    a = a * x * x * 2;
    b = b * y * y;
    c = a + b;
    return c;
}
int main() {
    int result;
    test c1(6, 4);
    result = c1.sample(3, 2);
    cout << result << endl;
    getch();
    return 0;
}
```

$$b = 6 + 4 = 10$$

$$a = (11 \times 4) + (3 \times 3 \times 2) = 16 + 18 = 34$$

$$b = (10 \times 6) + (2 \times 2) = 36 + 4 = 40$$

$$c = a + b = 34 + 40 = 74$$

- 6) a. What is operator overloading? Write down the output of the following sequence of code: 4

```
#include <iostream>
using namespace std;
class complx {
    double real;
    double imag;
public:
    complx(double real = 0., double imag = 0.);
    complx operator+(const complx&) const;
    complx complx(double r, double i)
    {
        real = r;
        imag = i;
    }
};
```

```

    real = r, imag = i;
}

complex complex operator+ (const complex& c) const
{
    complex result;
    result.real = (this->real + c.real);
    result.imag = (this->imag + c.imag);
    return result;
}

int main()
{
    complex x(4,4);
    complex y(6,6);
    complex z = x + y; // calls complexoperator+()
}

```

- b. Can the address of an object be passed to a function as an argument? Explain, if it is possible. 3
- c. Given the following class hierarchy, in what order are the constructor functions called? In what order are the destructor functions called? 3

```

#include <iostream.h>

class A {
public:
    A() {cout<<"Constructing A\n";}
    ~A() {cout<<"Destructing A\n";}
};

class B: public A {
public:
    B() {cout<<"Constructing B\n";}
    ~B() {cout<<"Destructing B\n";}
};

class C: public B {
public:
    C() {cout<<"Constructing C\n";}
    ~C() {cout<<"Destructing C\n";}
};

int main()
{
    C obj;

    return 0;
}

```

- d. Explain why a virtual base class might be necessary?



- 7) a. What is Formatted I/O? Write down the functions of the following flags. 3
- skipws
  - left
  - internal
  - scientific
- b. What is I/O Manipulator? What are the purposes of the following Manipulators? 3
- boolalpha
  - fixed
  - flush
  - ends
- c. What is a virtual function? What types of functions cannot be made virtual? How does function overriding differ from function overloading? 4
- d. What is a pure virtual function? Distinguish between abstract class and polymorphic class? 2
- 8) a. What is exception handling? Briefly explain how try, catch, and throw work together to provide C++ exception handling. 4
- b. What is a generic function and what its general form? Create a generic function that returns the summation of an array of values. 4
- c. What form of catch will handle all types of exceptions? 2
- d. Here is a skeleton for a function called divide(). 2

```
double divide (double a, double b)
```

```
{
    //add error handling
    return a/b;
}
```

This function returns the result of dividing a by b. Add error checking to this function using C++ exception handling. Specifically, prevent a divide-by-zero error.