University of Michigan – Dearborn
Department of Computer & Information Science
CIS 200
Midterm Examination

February 24, 2021

Time: 150 minutes
Total Marks: 60

Professor: J. Shen
Closed Book

Name: _____

Email: _____

Directions:

Answer each of the following questions in the space provided in this exam booklet. If you must continue an answer (e.g. in the extra space on the last page, or on the back side of a page), make sure you clearly indicate that you have done so and where to find the continuation.

Where a discourse is called for, please be concise and precise. Write legibly; no marks can be given for answers, which cannot be decrypted.

Marks for each major question are given at the beginning of the question. There are a total of 60 marks.

Good luck.

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1. ____/10 2.____/10 3._____/10 4._____/10

5. ____/10 6.____/10

Total: _____

Question 1 (10 marks)

a) Describe how Unix controls file access and give one example (2 marks)

b) Explain the meaning of the following Unix commands. (2 marks)

$ date | mail –s “Date” shen@umich.edu

$ man sort > foo.txt

c) Explain Unix commands: **mkdir** and **mv** (2 marks)

d) What is UML ? Briefly explain two types of diagrams in UML. (2 marks)

e) Briefly explain two types of testing methods for software development and the major stages in software development cycles (2 marks)

Question 2 (10 marks)

a) Write a definition of a struct called Employee, which contains four fields: employment_id, int; salary, float; marriage_status, bool; last_name, string (3 marks).

b) Given the above Employee struct, declare a variable *x* of this data type, and assign the four fields, respectively, to the values: 1234, 34000.00, true, Maxwell. Then, declare another variable *y* of this data type and copy the content of *x* to the content of *y*. (3 marks).

c) Create a one-dimension array, *z*, of this struct data type with a length 2. Set the content of z as follows:
The first array element: 1235, 35000.00, false, Fox
The second array element: 1236, 36000.00, true, Smith

Pass *z* into a function: PrintArrayElement(…). Finish the interface of this function, and loop over each array element inside this function and print out the content of array *z*. (2 marks).

d) Write a function printAttribute( ) inside struct Employee. Give a coding example of calling this function in main( ). (2 marks)

Question 3 (10 marks)

A. Show the output of the following code. (5 marks)

```
#include <iostream.h>

void magic (int &a, int b, int& c)
{
  a *= 2;
  b = b+2;
  c = c-2;
}

int main ()
{
  int x=1, y=3, z=7;
  magic (x, y, z);
  cout << "x=" << x << ", y=" << y << ", z=" << z;
  magic (z, y, x);
  cout << "x=" << x << ", y=" << y << ", z=" << z;

  return 0;
}
```

What is the parameter passing scheme for a, b and c in magic( ) function ?

B. Show the output of the following code. (5 marks)

```
#include <iostream.h>

void printarray (int arg[], int length) {
  for (int n=length-1; n>=0; n--)
    cout << arg[n] << " ";
  cout << endl;
}

int main ()
{
  int firstarray[] = {5, 10, 15, 20, 25};
  int secondarray[] = {2, 4, 6, 8, 10};
  printarray (firstarray,3);
  printarray (secondarray,2);
  return 0;
}
```

Question 4 (10 marks)

A. Suppose the following letter grade class has been defined globally in a program.

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

class Grade {
  private:
    char grade;
  public:
     Grade(char in_grade);
      void print( );
  };

Grade::Grade ( char in_grade) {
       grade = in_grade;
  }
void Grade: print ( ) {
        cout << grade;
  }
```

Write a *main* function that reads one character from the keyboard, create a Grade object containing that character, and then have the object print itself. (3 marks)

Furthermore, create an output file (named "output.txt"), and save the character to this output file. Last, close this output file.

B. A multiple-choice question (2 marks)

At a certain high school students receive letter grades based on the following scale.

Numeric Score	Letter Grade
93 or above	A
From 84 to 92 inclusive	B
From 75 to 83 inclusive	C
Below 75	F

Which of the following code segments will assign the correct string to `grade` for a given integer score ?

I.
```
if (score >= 93)
  grade = "A";
if (score >= 84 && score <= 92)
  grade = "B";
if (score >= 75 && score <= 83)
  grade = "C";
if (score < 75)
  grade = "F";
```

II.
```
if (score >= 93)
  grade = "A";
if (84 <= score <= 92)
  grade = "B";
if (75 <= score <= 83)
  grade = "C";
if (score < 75)
  grade = "F";
```

III.
```
if (score >= 93)
  grade = "A";
else if (score >= 84)
  grade = "B";
else if (score >= 75)
  grade = "C";
else
  grade = "F";
```

(A) II only

(B) III only

(C) I and II only

(D) I and III only

(E) I, II, and III

C. What is the output of the following C++ program ? (3 marks)

```
int main ( )
{
    int a = 5, b= 8, c= 3, d, e, f, g;

    d = a&b;    e = a | c;   f = a >> 1, g = a << 1;

    cout << "d= " << d << " e = " << e  << " f = " << f  <<  "g = " << g << endl;
 }
```

Question 5 (10 marks)

Consider a class IntType with an array data member: value[200]. The size of this array is fixed. The IntType class has 7 member functions as follows:

- *IntType( ):* A default constructor that sets the each element of *value* array to zero.
- *IntType(int x[]):* A parameterized constructor that has one input parameter, a integer array. The content of this x[] should be copied to value array. Assume the length of the x array is also 200.
- *Operator=(IntType &y):* An overloaded operator = for this IntType class.
- *IntType(const IntType &x):* A copy constructor that has one input parameter of type IntType.
- *bool* operator ==(IntType &y); // if any array element is different, return // false; otherwise, return true.
- IntType& operator ++(): pre-fix ++, which increments each array element by 1 before the assignment operation.
- IntType operator ++(int): post-fix ++, which increments each array element by 1 after the assignment operation.

Class IntType

```
{
        public:
                IntType( );
                IntType(int x[]);
                operator=(IntType &y);
                IntType(const IntType &x);
                bool operator ==(IntType &y);
                IntType& operator ++();   // pre-fix ++
                IntType operator ++(int);  // post-fix ++
        private:
                int value[200];
}
```

Write the implementation (i.e., the detailed definition) of all six member functions (7 marks)

Draw a UML class diagram for this class (3 marks).

Question 6 (10 marks)

A. Explain the steps for deleting one item from an unsorted list. (2 marks)

B. What is the purpose to use friend in C++? Is it a one-way relationship in C++? (2 marks)

C. What is the main difference between protected and private? What is the role of inheritance type ? (2 marks)

D. Give a definition of software engineering. Explain how assert( ) could enforce the correctness of your code. (2 marks)

E. Assume that you have a two-dimensional array: float x[30][40]. The values of this array elements have been assigned. Write a segment of code to calculate the average of those array elements (2 marks)