COSC202 Midterm 10/9/2025 Instructions

Please answer all questions.

Please write your answers on the test in the spaces provided.

Please put your name and username on all sheets.

I advise that you do you work on scratch paper, and then when you're done, put your answers onto the exam.

Please put your name/username on your scratch paper too, and turn that in.

Good luck!

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Name/username: _____

Question 1

Q1A: What is 256 in hexadecimal?
_____

Q1B: What is 2568 in hexadecimal?
_____

Q1C: What is 0x5e in decimal? _____

Q1D: A value is 100110111101 in binary. What is it in hexadecimal? _____

Q1E: What is (0x189 << 8) in hexadecimal?
_____

Q1F: What is (0x128 >> 4) in hexadecimal?
_____

Question 2

The last command below prints four lines. Please enter them below:

```
UNIX> cat xxx.cpp
#include <iostream>
#include <vector>
using namespace std;

int main()
{
  vector <string> yvec;
  string t;

  while (!cin.eof()) {
    cin >> t;
    yvec.push_back(t);
  }
  yvec[0][0]++;
  cout << yvec[0] << endl;
  cout << yvec[1] << endl;
  cout << yvec[2] << endl;
  cout << yvec.size() << endl;
  return 0;
}
UNIX> g++ xxx.cpp
UNIX> cat f1.txt
55 52 76
17 77 70
26 93 91
UNIX> ./a.out < f1.txt
```

Q2A: Line 1: _____

Q2B: Line 2: _____

Q2C: Line 3: _____

Q2D: Line 4: _____

Question 3

Behold the following class definition and implementation:

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

class E1 {
  public:
    E1(string f, string l);
    ~E1();
  protected:
    string *cp;
};
```

```
E1::E1(string f, string l)
{
  cp = new string;
  *cp = f + " " + l;
}

E1::~E1()
{
  delete cp;
}
```

Q3A: Explain to me why I need to implement the destructor as I have implemented it.

Q3B: Tell me two different ways that E1's copy constructor can be called.

_____

_____

Q3C: Tell me why I need to implement E1's copy constructor, and not use the default copy constructor.

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Question 4: For each part of this question, please assume that the hash table is in the state shown below. For parts A, B and J, please answer the question. For the other parts, I give you a name and a collision resolution strategy. For parts C through I, tell me the index where the name will be inserted, with the given collision resolution strategy. Please assume that Hash-1 is used as the primary hash function, and for double-hashing, that Hash-2 is the second hash function.

0	"Leah Behind MD"
1	
2	
3	"Sofia Wotan"
4	
5	"Alexis Antecedent"
6	"Connor Barge"
7	"Riley Barter"
8	"Ryan Featherbrain"
9	"Carter Multi"
10	"Matthew Taboo"
11	"Mia Phrase"
12	
13	"Austin Adieu"
14	"Zoey Prophetic"
15	"Peyton Abundant"
16	"Suzy Etude"
17	"Wyatt Tyler Biharmonic"
18	
19	"Christian Coda"
20	"Jake Ptarmigan PhD"
21	"Savannah Pius MD"
22	"Charlie Newlywed"
23	"Carson Swath IV"
24	"Emily Aqueduct"
25	"Eva Pemmican"
26	"Landon Attorney"
27	"Molly Flat"
28	"Audrey Idyllic"
29	
30	"Brianna Chromatograph"
31	"Avery Not"
32	
33	
34	"Luke Hassle"
35	"Ava Lapse"
36	"Elijah Joshua Exeter"
37	
38	"Cooper Conjugate III"
39	
40	"Elizabeth Them"
41	"Gavin Irreconcilable"
42	
43	"Avery Quake"
44	
45	
46	
47	"Morgan Transparent"
48	"Kaitlyn Trevelyan"
49	"Luke Austin Sony"

Name	Hash-1	Hash-2
"Amelia Cognate"	4193470511	2923041557
"Charlie Eli Fatuous"	3576926366	1773866167
"Chase Carleton"	2067375105	3354878257
"Christopher Titillate"	2540337020	3221493827
"Eva College"	2515584028	1872682207
"Hannah Scheme"	3696226248	3381612259
"Isabelle Keyes Esq"	2866043024	1103660507
"Jonathan Contentious"	4269490483	2279653561
"Jordan Yugoslav III"	2544017976	2746040763
"Kayla Moon"	2437941840	1226913689
"Mackenzie Skyrocket"	1594326555	3584681891
"Maya Rumpus"	2334252185	2297352425
"Mia Exigent"	990310448	874404823
"Michael Chautauqua"	2225817034	240622377
"Morgan Constraint Esq"	3485384375	2408714027
"Sophia Oxcart"	191479578	3850887449
"Tristan Wack"	62113904	3317662907
"Tyler Encomium"	1378840114	391770363

Q4A: What is the load factor of this table?
You may give a fraction: _____

Q4B: Is this a good load factor? Answer Y or N: _____

Q4C: "Mia Exigent", Linear Probing: _____

Q4D: "Chase Carleton", Double Hashing: _____

Q4E: "Michael Chautauqua", Linear Probing: _____

Q4F: "Eva College", Double Hashing: _____

Q4G: "Christopher Titillate", Quadratic Probing: _____

Q4H: "Hannah Scheme", Quadratic Probing: _____

Q4I: "Tristan Wack", Linear Probing: _____

Q4J: In the table above, there is one name which is impossible to insert into the table with double-hashing. What is that name? (You should be able to answer this quickly. If not, skip it, and move on):
_____

Name/Username:

Question 5

The following program prints 8 lines of output:

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

int main()
{
  vector <int> vvec;
  vector <int *> wp;
  int *a;
  int *l;
  int i;

  for (i = 0; i < 3; i++) {
    a = new int;
    *a = 20 + i;
    vvec.push_back(*a);
    wp.push_back(a);
    *a += 10;
    l = a;
  }

  a = wp[0];
  *a += 7;

  cout << vvec[0] << endl;
  cout << vvec[1] << endl;
  cout << vvec[2] << endl;
  cout << *(wp[0]) << endl;
  cout << *(wp[1]) << endl;
  cout << *(wp[2]) << endl;
  cout << *a << endl;
  cout << *l << endl;
  return 0;
}
```

Q5A: What is the first line of output?
_____

Q5B: What is the second line of output?
_____

Q5C: What is the third line of output?
_____

Q5D: What is the fourth line of output?
_____

Q5E: What is the fifth line of output?
_____

Q5F: What is the sixth line of output?
_____

Q5G: What is the seventh line of output?
_____

Q5H: What is the eighth line of output?
_____

Q5I: Is there a memory leak in this program? (Y|N) _____

Question 6

Behold the following program - note, **D()** and **E()** have been written by someone else:

```
/*  1 */ #include <iostream>
/*  2 */ using namespace std;
/*  3 */ class C1 {
/*  4 */  public:
/*  5 */    C1(int s);
/*  6 */    int D();                  // We don't know how D()
/*  7 */    int E(string &x) const;  // or E() is implemented.
/*  8 */    int F(string &s);
/*  9 */   protected:
/* 10 */     int seed;
/* 11 */ };
/* 12 */
/* 13 */ C1::C1(int s)
/* 14 */ {
/* 15 */   seed = s;
/* 16 */ }
/* 17 */
/* 18 */ int C1::F(string &s)
/* 19 */ {
/* 20 */   int x;
/* 21 */   int newseed;
/* 22 */   string s2;
/* 23 */
/* 24 */   x = seed + s.size() + s[0] + D();
/* 25 */   newseed = (seed << 5) + seed ^ s[0];
/* 26 */   s2 = s.substr(1);
/* 27 */   s = s2;
/* 28 */   seed = newseed;
/* 29 */   return x + newseed + E(s);
/* 30 */ }
/* 31 */
/* 32 */ int main()
/* 33 */ {
/* 34 */   string s;
/* 35 */   C1 *c1;
/* 36 */   C1 other_c1;
/* 37 */
/* 38 */   s = "Thor";
/* 39 */   c1 = new C1(50);
/* 40 */   cout << c1->seed << endl;
/* 41 */   cout << c1->F(s) << endl;
/* 42 */   cout << s << endl;
/* 43 */   return 0;
/* 44 */ }
```

Q6A: There are two lines in this program that will cause a compiler error: What lines are they? _____ _____

Q6B: Suppose that I declare the **F()** method as: "int F(const string &s)" and the implementation as "int C1::F(const string &s)". What two lines will cause compiler errors as a result?
_____ _____

Q6C: Suppose that I declare the **F()** method as: "int F(string &s) const" and the implementation as "int C1::F(string &s) const". What two lines will cause compiler errors as a result?
_____ _____

Name/Username:

Question 7

Below, write a procedure named **ReadVec()** that reads a single line from standard input, and returns a vector containing the words on that line. If it fails to read from standard input, then it should throw an exception with the string "Failed".

Question 8

Below, write a procedure with the following prototype:

```
bool find(const string &s, const vector <string> &ht);
```

that uses quadratic probing to determine if the string **s** is in the hash table **ht**. **find()** should return **true** if it is, and **false** if it is not. An empty string in **ht** denotes an empty hash table entry. Please assume that the hash function is implemented by the function **hash** with the following prototype:

```
int hash(const string &s);
```

You may also assume that the hash table size is a prime number, and that the hash table is not full.