PIC 10A
Introduction to Programming

Midterm

Instructions...

• Gradescope...
  – You have until **Friday May 7** at 11:59pm PST to submit your solutions to Gradescope.
  – Make sure that you correctly tell Gradescope on which **pages you answer each question**.

• Class on Monday May 3 at 1pm is cancelled to give you more time this week.

• Exam conditions???
  – I think it is beneficial for you to attempt the exam under exam conditions **at first**.
  – After you have evaluated your progress by attempting the exam under exam conditions, you can spend as long as you wish writing up **perfect solutions** with full explanations.
  – **Only** submit your perfect solutions. We do **not** need to see your previous attempts.

Name: __________________________
Student ID number: _____________________
Discussion: __________________________

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<tr>
<th>Question</th>
<th>Points</th>
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<td>1</td>
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<td><strong>Total:</strong></td>
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In every question, you should assume that

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

has been typed at the start.

**Problem 1. 6pts.**

**Explain** the output of the following code.

```cpp
int main() {
    cout << boolalpha;
    cout << (100.0 * 20.15 < 2015.0) << endl;
    cout << static_cast<int>(100.0 * 20.15) << endl;
    cout << 'g' - 'b' << endl;
    char ch = 'D' + 'a' - 'A';
    cout << ch << endl;
    string s = "AAARGH!!!";
    if (s.find("AAA")) { cout << 1 << endl; }
    if (s.find("RGH")) { cout << 2 << endl; }
    if (s.find("???")) { cout << 3 << endl; }

    return 0;
}
```

**For full credit,** your explanation must use the following words appropriately:

- `int`, `double`, `bool`, `char`, `size_t`,
- `static_cast<int>`, `static_cast<bool>`, `static_cast<char>`, `static_cast<size_t>`,
- `console`, `display`, `displays`, `displayed`, `assign`, `assigns`, `assigned`, `assignment`,
- `implicit`, `convert`, `converts`, `converted`, `conversion`, `zero`, `non-zero`,
- `rounding`, `truncate`, `truncates`, `truncated`, `truncation`. 
Problem 2. 6pts.

Explain the output of the following code by...

- carefully keeping track of the input buffer (you should clearly display the contents of the input buffer after every significant line of code);
- carefully following the instructions on pages 5 and 6 of the supplementary materials which describe how `cin >> variable`, `getline(cin, s)`, `cin.ignore()`, `cin.get()`, `cin.peek()` work (e.g. you should explicitly use steps 1 to 4 for `cin >> variable`).

```cpp
int main() {
    cout << "Type (not copy and paste) the four (not three)" << endl;
    cout << "commented lines of code (ending each by pressing ENTER):" << endl;
    /*
    9 8
    7 6543
    2 1012 345 678 911
    */
    int i1, i2, i3, i4, i5;
    char c1, c2;
    string s;

    cin >> i1;
    cin >> i2;
    getline(cin, s);

    cin >> i3;
    cin.ignore();

    c1 = cin.peek();
    c2 = cin.get();

    cin >> i4 >> i5;
    cout << endl;

    cout << "Line 1: " << i1 << endl; // These variables
    cout << "Line 2: " << i2 << endl; // are printed in
    cout << "Line 3: " << s << endl; // the same order
    cout << "Line 4: " << i3 << endl; // that they are
    cout << "Line 5: " << c1 << endl; // assigned to.
    cout << "Line 6: " << c2 << endl;
    cout << "Line 7: " << i4 << endl;
    cout << "Line 8: " << i5 << endl;

    return 0;
}
```
Problem 3. 6pts.

Explain the output of the following code with the aid of a picture.

```cpp
int f(int& i, int j) {
    int tmp = i;
    i = j;

    if (tmp == 8) { cout << tmp << ' ' << i << ' ' << j << endl; }

    j = tmp;
    return j;
    return i;
}

int main() {
    int i = 8, j = 1, k = 0;

    f(j, k);
    cout << i << ' ' << j << ' ' << k << endl;

    i = f(i, j);
    cout << i << ' ' << j << ' ' << k << endl;

    return 0;
}
```

For full credit, your picture must...

- display a function scope for each function call;
- display all function parameters in the appropriate place;
- draw references consistently with how they were drawn in lecture;
- indicate the full history of values that each non-referencing variable has;
- indicate the order that values are updated or introduced, and scopes are introduced and destroyed.

You can satisfy the last bullet point by labelling your picture with numbers in a different color to your normal writing. I am happy to demonstrate this idea in office hours. You should expect to use at least the numbers from 1 to 11. It is reasonable to lump together the introduction of a function scope and the initialization of the function parameters. It is also reasonable to lump together the destruction of a function scope and the impact of a returned value. This video (a link you can click) should be useful.

For full credit, your prose must...

- disambiguate variables in main and variables in a function scope (if they happen to have the same name);
- explain issues concerning the return keyword carefully.