CS 7A - fall 2016 - Midterm 2. 12/5/16

Write your responses to following questions on separate paper. Use complete sentences where appropriate and write out code using proper style and syntax. You can hand write your responses or type set with a computer.

1. Consider the following complete program:

```
#include "std_lib_facilities.h"
void multiply(double d1, double d2)
{   double temp = d1; // copy d1's value to temp
    d1 = d2;          // copy d2's value to d2
    d2 = temp;        // copy d1's old value to d2
}
int main()
{   double x = 1;
    double y = 2;
    cout << "x == " << x << " y== " << y << '\n';
    swap(x,y);
    cout << "x == " << x << " y== " << y << '\n';
}
```

   (a) What does the program print to the console?

   (b) How would you change it to meet the intended swap?

   (c) Describe how your change affects the program's use of variables and memory.

2. Consider the following complete program:

```
#include "std_lib_facilities.h"
class UDT {
public:
    int m;              // data member
    int mf(int v) { int old = m; m=v; return old; } // function member
};
int main()
{   UDT var;            // var is a variable of type UDT
    var.m = 7;          // assign to var's data member m
    cout << "\nm = " << var.m;
    int x = var.mf(9);  // call var's member function mf()
    cout << "\nm = " << var.m;
    return x;
}
```

   (a) What is printed to the console?

   (b) What value is returned by `main()` ?

   (c) How would you change the `UDT` to make the data member private? The output

3. Consider the following complete program:

```
class T
{   int m;
    int mf() { return m; }
public:
    int f(int i) { m=i; return mf(); }
};
int main()
{   T t;
    int y = t.mf();
    //int y = t.f(8);
    return y;
}
```

   (a) Explain in detail what the function `f()` does.

   (b) As is, the program has an error.

   (c) How would you modify the program so that it has no error and `main()` returns the value 8?

4. Consider program implementing a `Pet` class as partially listed below:

```
#include "std_lib_facilities.h"
class Pet {
private:
    string kind;
    string name;
    int birthday; // date in the form "20170101" for Jan 1, 2017
    int age; // pet's age
public:
    Pet(string k, string n, int bday) : kind(k), name(n), birthday(bday) { };
    Pet() { cout << "\nYou've created a Pet."; }
    string get_kind();
    string get_name();
    int get_age();
    void updateAge(int); /// use birthday
    void set_kind(string s) { kind = s; }
    void set_name(string n) { name = n; }
    void set_bday(int b) { birthday = b; }
    void speak();
};
void init_pet(Pet& p)
{   string k, n;
    int birth;
    cout << "\nWhat kind of pet are you creating? ";
    cin >> k;
    p.set_kind(k);
    /// Answer question 4b
}
int Pet::get_age()
{   /// answer question 4a
}
void Pet::speak()
{   if(kind=="dog")
        cout << "\nWoof! My name is "<<name<<" and I'm a "<<get_age()<<"-year old "<<kind;
    /// answer question 4c
}
void Pet::updateAge(int today) {
    /// answer question 4d
}
int main()
{   cout << "\nEnter today's date.  Use, say, 20161205 for Dec. 5, 2016: ";
    int today;
    cin >> today;
    Pet dog("dog", "Bix", 20141231);
    dog.updateAge(today);
    dog.speak();
    Pet cat;
    init_pet(cat);
    cat.updateAge(today);
    cat.speak();
}
```

That can produce this user interaction, when complete:

```
Enter today's date.  Use, say, "20001105" for "Nov. 5, 2000": 20161205

Woof! My name is Bix and I'm a 2-year old dog

You've created a Pet.
What kind of pet are you creating? cat
What is your pet's name? Fluffy
What is your pet's birthday? (use, say, "19990228" for "Feb. 28, 1999)": 10161205

Meow! My name is Fluffy and I'm a 1000-year old cat
```

Questions are on the next page:

(a) Provide an appropriate body for Pet's method `get_age()`

(b) Complete the definition of `init_pet()` so that line 47 will execute properly.

(c) Add code to `Pet`'s `speak()` method so that line 49 will execute properly.

(d) Use integer division(/) and the modulo operator(%) so that `updateAge` gives the correct age.

(e) Why is the parameter passed by reference in `init_pet()`?

5. Consider the following code fragment for the user-defined type, `Token`:

```
#include "std_lib_facilities.h"
class Token {
public:
    char kind;          // what kind of token
    double value;       // for numbers: a value
    Token(char ch)      // make a Token from a char
        :kind(ch), value(0) { }
    Token(char ch, double val)   // make a Token from a char and a double
        :kind(ch), value(val) { }
};

Token get_token();      // read a token from cin

vector<Token> tok;      // we'll put the tokens here

int main()
{   while (tok.size()<5) {
        Token t = get_token();
        tok.push_back(t);
    }
    double d = tok[0].value, temp;
    for (int i = 0; i<tok.size(); ++i) {
        temp = d;
        if (tok[i].kind=='*') {     // we found a multiply!
            d *= tok[i+1].value;
            cout << temp << '*' << tok[i+1].value << '=' << d << endl;
        }
    }
}
Token get_token() {
    char ch;
    double val;
    cin >> ch;
    switch(ch) {
    case '2': case '3': {
        cin.putback(ch);
        cin >> val;
        return Token('8',val);
    }
    case '*':
        return Token(ch,0);
    }
}
```

(a) What type of object is the variable `tok` in this program and what is its scope?

(b) Describe what happens on lines 17-20 of `main()`. What, specifically is produced if the user enters "3*2*3"?

(c) Make a table threading the values of `i`, `d`, and `temp` for the code in lines 21-28 if the user enters "3*2*3".

(d) What is output to the console if the user enters "3*2*3"?

(e) How would you modify the code so the the result of entering "1*2/2*2" is computed correctly according to the order of operations? (ie, left to right for multiplication and division). You will need to modify both `main()` and `get_token()`.