Midterm Answers – CS 246 Fall 2009

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These are not the only answers that are acceptable; these answers come from the notes or lectures.

1. (a) **2 marks** A *shell* is a program that reads commands and interprets them.
   (b) **3 marks** File names are organized in a hierarchy: directories are vertices, files are leaves.
   (c) **2 marks** *Hidden files* start with "." (dot) and are hidden because they contain administrative information.
   (d) **3 marks** [!xyz]*.cc
   (e) **3 marks** Users are organized into groups *user*/*owner*, *group*, *other*, with access control *read*, *write*, *execute*/*search*.

2. (a) **1 mark** The range of values for **int** is machine specific.
   (b) **2 marks** i : 3, k : 3, i : 4, i : 4
   (c) **3 marks**
      i. A string cannot contain a character with the value ʹ\0ʹ.
      ii. String operations needing the length of a string must linearly search for ʹ\0ʹ, which is expensive for long strings.
      iii. Management of variable-sized strings is the programmer's responsibility, with complex storage management problems.
   (d) **2 marks** C++ string type uses a length member and manages all of the storage for the variable-sized strings.
   (e) **2 marks** A *designated constant* indicates its type with suffixes: L/l for long, LL/ll for long long, U/u for unsigned, and F/f for float. (May show specific examples of designated constant, e.g., 1L, 3u, 1.0f.)

3. (a) **2 marks** It can mean either assign the pointer values or assign the values the pointers are pointing to.
   (b) **6 marks** 1 for the stack, 1 for each variable on the stack.

```
          ,----------,
          | r   : ----+-,
     rtn  | i   : 7 <-+-'<--,
          | pr  : ----+--,  |
          }----------{  |  |
          | i   : 3   |<-'  |
     main | pi  : ----+-----'
          '----------'
```

   (c) **2 marks** Only deletes the first element of the array; use **delete** [] parr
   (d) **1 mark** Allocating a variable on the stack is more efficient than in the heap.

4. (a) **2 marks** operators lhs += rhs is implicitly rewritten as:

   temp = &(lhs);   *temp = *temp + rhs;

   (b) **2 marks** *coercion* is a cast *without* a conversion, forcing one type to another. Coercion breaks the type system.

   (c) **2 marks** *short-circuit* evaluation lazily performs the minimal computation to generate a result. (May be phrased in terms of "&&" and "||".)

   (d) **1 mark** flag variables

   (e) **2 marks** **#define** statement declares a preprocessor variable, and assigns as its value all the text after the name up to the end of line. After the **#define** statement the preprocessor substitutes the name with its value in the program.

5. (a) **2 marks** *Formatted I/O* transfers data with implicit conversion of internal values to/from human-readable form. *Unformatted I/O* transfers data without conversion, e.g., internal integer and real-floating values.

   (b) **1 mark** False

   (c) **2 marks** *pass by value*: parameter is initialized by the argument (usually with bit-wise copy). *pass by reference*: parameter is a reference to the argument and is initialized to the argument's address.

   (d) **2 marks** Routine pointers generalize a routine by allowing a routine to have a flexible (changeable) algorithm that varies depending on the supplied code.

6. **10 marks**

```
2   prog1=${1}                              # copy first 4 parameters
-   args1=${2}
-   prog2=${3}
-   args2=${4}
1   shift 4                                 # remove first 4 parameters

1   for testfile in ${@} ; do               # process each test file
1       eval ${prog1} ${args1} ${testfile} > tmp1_${$} 2>&1 # run programs and save output
1       eval ${prog2} ${args2} ${testfile} > tmp2_${$} 2>&1
1       diff tmp1_${$} tmp2_${$}            # compare output from programs
1       if [ ${?} -eq 0 ] ; then            # check return code
1           echo "identical output"
        fi
1       rm tmp1_${$} tmp2_${$}             # clean up temporary files
    done
```

7. **16 marks**

```cpp
1    #include <iostream>
1    #include <fstream>
1    using namespace std;

1    union IEEE {
1        double d;
1        struct {
1            unsigned int sign : 1;              // sign
1            unsigned int exp : 11;              // exponent
1            unsigned long long int val : 52;    // fraction
         } ieee;
     } u;

1    int main( int argc, char *argv[] ) {
1        ifstream in( argv[1] );
1        for ( ;; ) {
1            in.read( (char *)&u.d, sizeof( u.d ) );
1          if ( in.fail() ) break;
2            cout << "d:" << u.d << "\tsign:" << u.ieee.sign
                 << "\texp:" << hex << u.ieee.exp
                 << "\tfrac:" << u.ieee.val << endl;
         }
     }
```

8. **10 marks**

```cpp
bool define( string line, string &name, string &value ) {
     unsigned int posn;
1    if ( line.substr( 0, 7 ) == "#define" ) {    // define directive ?
1        line = line.substr( 7 );                  // remove directive
1        posn = line.find_first_not_of( " \t" );   // find start of name
1        line = line.substr( posn );               // remove characters before name
1        posn = line.find_first_of( " \t" );       // find end of name
1        name = line.substr( 0, posn );            // remove name
1        value = line.substr( posn + 1 );          // remove value, without separator character
1        return true;
     } else {
1        name = value = "";
1        return false;
     } // if
}
```