

CMPUT-201 Midterm Exam, Winter 2006, Group A

Student Id: _____

Instructions:

- This is a “closed book” exam.
- No conversations, please. Cheating is lame and may have unpleasant consequences.
- Print your student id on this page and your name and student id on all subsequent pages.
- Write your answers legibly in the space below or next to the questions. Use a pen. No other sheets are accepted.
- You may use the back of the sheets as scratch space.
- Skip questions you cannot answer immediately and return to them later.
- Important: I won't answer any questions regarding this exam. If unsure, state your assumptions clearly.

Good Luck!

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1:	2:	3:	4:
5:	6:	7:	8:

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1. How many bytes in memory do the following variables occupy on a machine with 32-bit memory addresses and 4-byte ints? (6 marks)

- A) `const double *x;`
- B) `bool x[1000];`
- C) `int x[20][30];`
- D) `struct Point { int x,y; } x[8];`
- E) `char *argv[10];`
- F) `union Foo { double a,b,c; int d; } x;`

2. What are the decimal values of integer variable `y` after the following assignments have been executed (`int a=b=c=23`): (6 marks)

- A) `y = a ^ a;`
- B) `y = a & 0xff;`
- C) `y = a >> (a & 3);`
- D) `y = a & (a-1);`
- E) `y = b *= 3;`
- F) `y = *&++c;`

3. The following function is supposed to convert all upper-case letters in a given string into lower-case letters. Correct all syntactic and semantic errors using a minimal number of changes. Recall that C-strings are terminated by a 0-byte. (4 marks)

```
void to_lower_case(const char *s)
{
    for (i=1; s[i] = 0; ++i) {

        if (s[i] >= "a" || s[i] <= "z")

            s[i] = s[i] + "a" - "A";
    }
}
```

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4. Complete the following makefile that creates an unoptimized executable `foo` from `foo.c` which includes `foo.h`, Compiler warnings must be turned on. Also add phony target `submit` whose commands archive `foo.h` and `foo.c` into `foo.tar` and submit it via `astep -c c201 -p asn13 files.tar` (4 marks)

```
CC      := g++
CCOPTS :=
```

```
foo:
```

5. What is the text generated by the C preprocessor when processing the following input?(4 marks)

```
#define FOR(i,n) for (int i=0; i < (n); ++i)
#define MAX(x,y) ((x)>(y)?(x):(y))
#define X(a) (a).x

FOR (j, N*M) X(a[j]) = MAX(X(a[j]),X(b[j])); // compute vector maximum
```

6. Give UNIX commands for the following tasks: (6 marks)

- A) Create directories `foo1,foo2,foo3`
- B) Copy a directory `foo` into directory `~/backup`
- C) List all files with access permissions in the current directory
- D) Display location of C++ header file `iostream`
- E) Count the number of unique lines in file `foo`
- F) Display information about the CPU(s) on a Linux system

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7. Write a function that rotates an `unsigned int x` (occupying 32 bits) `k` bits to the right. Rotation means that — unlike regular shift operations — bits that are shifted out reappear at the other end of the sequence (see example below). (6 marks)

```
void rotate_right(unsigned int &x, int k)
{
    assert(k >= 0 && k < 32);
    assert(sizeof(x) == 4);

    // ...

}
```

// Example:

```
unsigned int x = 5; rotate_right(x, 2); // x now 0x40000001
```

8. Indicate by circling T or F, whether the following statements are true or false. (11 marks)

[**Important!** One mark for each correct answer; two wrong answers are free; one mark is deducted for any additional wrong answer; not answering is an option resulting in 0 marks for that question; mark total ≥ 0]

- | | | |
|--|---|---|
| A) The linker reports missing function definitions | T | F |
| B) Local function parameters are stored on the heap | T | F |
| C) Floating point arithmetic is accurate | T | F |
| D) Assigning 32-bit integers to double variables may lose information | T | F |
| E) Integer overflows cause program termination | T | F |
| F) When passed to functions, C-arrays do not carry length information | T | F |
| G) Local variables in C are automatically initialized | T | F |
| H) Macro expansion can be unsafe because of unwanted additional side effects | T | F |
| I) Makefile variables are expanded recursively | T | F |
| J) The preprocessor does not know anything about C types | T | F |
| K) Arrays are passed by reference | T | F |