

**UNCA CSCI 235**  
**Exam 2 (Near Final) Fall 2017**  
28 November, 2017

This is a closed book and closed notes exam. Communication with anyone other than the instructor is not allowed during the exam. **Furthermore, calculators, cell phones, and any other electronic or communication devices may not be used during this exam.** Anyone needing a break during the exam must leave their exam with the instructor. Cell phones or computers may not be used during breaks.

For this exam, you are allowed a two-sided page with handwritten notes.

*If you want partial credit for imperfect answers, explain the reason for your answer!*

Name: \_\_\_\_\_

**Problem 1 (20 points) C expressions**

In the left column, there are ten tricky and not-so tricky C expressions. Write their values in the right column. Express your answers in base 10. You may assume that all of these numbers are stored in 16-bit two's complement representation.

<b>~17</b>	
<b>!17</b>	
<b>17   5</b>	
<b>17    5</b>	
<b>17 &gt;&gt; 2</b>	
<b>17 &lt;&lt; 2</b>	
<b>17 &lt; 5</b>	
<b>17 / 5</b>	
<b>17 == 0x11</b>	
<b>1 &amp;&amp; 2017*235</b>	

**Problem 2 (10 points) Decimal to two's complement conversion**

Convert the following two signed decimal numbers into eight-bit *two's complement* representation, the byte of Java. Some of these numbers may be outside the range of representation for eight-bit two's complement numbers. Write "out-of-range" for those cases.

<b>130</b>	<b>-1</b>
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**Problem 3 (10 points) Decimal to Q4.4 conversion**

Convert the following two signed decimal numbers into Q4.4 *two's complement* numbers (four fixed and four fractional bits) into signed decimal representation. If you can't express the number exactly, give the nearest Q4.4 representation.

-3.75
7.3

**Problem 4 (10 points) C structure definition**

Define a C data struct (struct) that would be appropriate for holding the following three values:

- Name of an automobile brand, *e.g.*, Rambler
- Name of an automobile model, *e.g.*, Palm Beach
- Number of cup holders in automobile, *e.g.*, 6

**Problem 5 (10 points) Declaring and initializing a structure**

Suppose you had a file containing several lines of comma-separated input similar to the following:

```
Rambler, Palm Beach, 6
```

Further assume that the file pointer `carIn`, of type `FILE *` (of course) has been opened for reading from this.

Complete a call to `fscanf` to read *one* of these lines into the data structure you wrote in Problem 4. I am giving you the first four tokens needed for the call. (You don't need to check return codes.)

```
fscanf(carIn, _____ ...
```

**Problem 6 (20 points) Summing up an array**

Write a C function called `sumHolders` that, when passed an array of your Problem 4 structures along with the number of elements in that array, returns the total number of cup holders in all the cars passed in the array.

```
int sumHolders ( _____, int size) {
```

**Problem 7 (6 points)**

In a recent lab you were introduced to the following structure:

```
struct noteInfo {
    int frequency ;           /* frequency in Hz */
    long duration ;         /* duration in mSec */
}
```

Write a procedure numPeriods, with the following signature

```
int numPeriods(struct noteInfo *note)
```

that returns the period of the note in microseconds, that is, 1000000 divided by the frequency of the note. (This is a one-liner.)

```
int numPeriods(struct noteInfo *note) {
```

**Problem 8 (14 points)**

Suppose your computer can retrieve a value from the cache in 10  $\mu$ sec and from DRAM in 1 msec.

What is the average memory access time if the cache hit rate is 0.99?

What is the average memory access time if the cache hit rate is 0.9?