COS 126 Exam Review

• Exams overview
• Example programming exam
• Example written exam questions (part 1)
Exams tab on the booksite

See Exams tab for full details and old exams.
- Read carefully before each exam.
- Policies are the contract between us and you.

Policies (written exam).
- Closed book/notes/computer.
- 1 page (one side) cheatsheet.
- [two sides for Exam 2.]

Watch this space for details
Things to remember about inclass exams

**We know that you don't have much time.**
- Exams are 50 minutes.
- "One page" programming exams.
- Five-minute questions on written exams.

**We have to grade the exams.**
- 400+ exams.
- No open-ended questions.
- Fully prepared rubrics.

**Old exams are not completely reliable.**
- Course offerings differ slightly.
- We have made mistakes in the past.
Written Exam Logistics

The first exam is on Thursday Oct. 18.

You don't all fit in this room.
- Pay attention and know where to go.
- Arrive early.
- No calculator/phone/computer/headphones

Advice.
- Review lectures/reading.
- Try an old exam (untimed).
- Try another one (timed).
- Review a few more.
Example question: Input and output

Q. Do you understand basic ways of communicating with your programs?

Ex. (S2011 Q4) Give the results of invoking this program with the given commands.

```java
public class Q4 {
    public static void main(String[] args) {
        int curr = StdIn.readInt();
        StdOut.print(curr + " ");
        int prev = curr;
        while (!StdIn.isEmpty()) {
            curr = StdIn.readInt();
            StdOut.print((prev + curr) / 2 + " ");
            prev = curr;
        }
        StdOut.println();
    }
}
```

% more input.txt
2 4 6 8 10 12 8 2
% java Q4 < input.txt
2 3 5 7 9 11 10 5
% java Q4 < input.txt | java Q4
2 2 4 6 8 10 10 7

Note: It prints the first number, then the average of each number and its predecessor.
Example question: Functions

Q. Do you understand basic mechanisms for invoking functions?

Ex. (S2018 Q7) Give the contents of the array a[] after executing the given code.

```java
public static int halve1(int x) {
    x = x / 2;
    return x;
}

public static void halve2(int[] a) {
    for (int i = 0; i < a.length; i++) {
        halve1(a[i]);
        a[i] = halve1(a[i]);
    }
}
```

```
int[] a = { 16, 32, 48, 64 };
halve2(a);

8 16 24 32   NOT   4 8 12 16
```

```
int[] a = { 16, 32, 48, 64 };
halve2(a);
halve2(a);

4 8 12 16
```
Example question: Functions

Ex. (S2018 Q7) Give the contents of the array $a[]$ after executing the given code.

definition
public static void halve3(int[] a)
{
    int n = a.length;
    int[] b = new int[n/2];
    for (int i = 0; i < n/2; i++)
        b[i] = a[i];
    a = b;
}

int[] a = { 16, 32, 48, 64 }; halve3(a);
halve3(a);

16 32 48 64
Example question: Recursion

Q. Can you figure out the effect of a simple recursive program (or two)?

Ex. (Fall 2017 Q5) Fill in the values returned by these mutually recursive functions:

```java
public static int mystery1(int n) {
    if (n == 0) return 0;
    else return mystery2(n - 1);
}
public static int mystery2(int n) {
    if (n == 0) return 1;
    else return mystery1(n - 1);
}
```

<table>
<thead>
<tr>
<th>n</th>
<th>mystery1(n)</th>
<th>mystery2(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
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<tr>
<td>2</td>
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<td>4</td>
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<tr>
<td>5</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

Write one line of code that could replace the body of mystery(1).

```
return n % 2;
```
Example question: Binary operations

Q. Why is \( \sim 0 \) equal to \(-1\) and not \(1\)? (Fall 2014 Q1B)

A (wrong).
\( \sim \) is "not"
0 is "false"
"not false" is "true"
"true" is 1

A (correct).
\( \sim \) is \textbf{BITWISE} "not"
0 is \(00000000000000000000000000000000\)
\(\sim 0\) is \(11111111111111111111111111111111\)
\(11111111111111111111111111111111\) is \(-1\) (2s complement)
### Example question: TOY/number representation

Q. (Fall 2013 Q8) Consider this sequence of TOY instructions:

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
</table>

#### Questions:

Q. What is the value of \( R[7] \) after this sequence if it was initially 0025?

Q. In English, what does sequence do to \( R[7] \)?

Negates it.

To negate a 2s complement number: *flip its bits and add 1*
Example question: TOY

Q. Can you simulate the effect of a very simple TOY program?

Ex. (Fall 2016 Q7) Suppose that you load the following into memory locations 10-17 of TOY, set the PC to 10, and press RUN. Give the result in 01 when 00 is initially 0001.

10: 8A00 R[A] <- M[00]
11: 7101 R[1] <- 1
13: D216 if (R[2] > 0) PC <- 16
15: C012 PC <- 12
16: 9101 M[01] <- R[1]
17: 0000 halt

```
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>10</td>
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<td>11</td>
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<td>17</td>
<td>0001</td>
<td>0002</td>
<td>0001</td>
</tr>
</tbody>
</table>
```
Example question: TOY

Q. Can you simulate the effect of a simple TOY program?

Ex. (Fall 2016 Q7) Suppose that you load the following into memory locations 10-17 of TOY, set the PC to 10, and press RUN. Give the result in 01 when 00 is initially 0006.

10: 8A00 R[A] <- M[00]
11: 7101 R[1] <- 1
13: D216 if (R[2] > 0) PC <- 16
15: C012 PC <- 12
16: 9101 M[01] <- R[1]
17: 0000 halt

10   0001   0006  12   0004   FFFC
11   0001   0006  13   0004   FFFC
12   0001   FFFA  14   0008   FFFC
13   0001   FFFA  12   0008   FFF9
14   0002   FFFA  13   0008   FFF9
15   0002   FFFE  14   0010   FFF9
16   0004   FFFE  13   0010   0004
17   0004   0004
Example question: TOY

Q. Can you **reason about** the effect of a simple TOY program?

**Ex.** (Fall 2016 Q7) Suppose that you load the following into memory locations 10-17 of TOY, set the PC to 10, and press RUN. Give the result in M[01] when M[00] is initially 1EAF.

```
10: 8A00 R[A] <- M[00]
11: 7101 R[1] <- 1
13: D216 if (R[2] > 0) PC <- 16
15: C012 PC <- 12
16: 9101 M[01] <- R[1]
17: 0000 halt
```

**load limit from M[00]**

```
x = 1
while (x <= limit)
{
    x = 2*x
}
```

**store x to M[01]**

1  
2  
4  
8  
10 
20 
40 
80 
100 
... 
2000
Good luck!