CS-152
Computer Programming Fundamentals
Midterm Exam

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Up Coming Schedule

Midterm Exam
In lab class:
Thursday - Friday, March 7 or 8

Class Friday in different location!
Midterm Exam:

- May bring one-page (back and front) of hand written notes.
- No calculators or other devices containing transistors.
- Questions like the i-clicker questions.
- Short answer - not multiple choice:
  - "This Java method compiles and runs. What is the output?"
  - "The Java code below contains a compile error. Which line and what is the error?"
  - "When the code below executes, a run-time error will occur. What error will be reported and on which line?"

Common Errors #1: Name

_and output that is only a few letters_

For more info...

Google "How to print letters"
Common Errors #2: > < symbols

"greater than" symbol: >
8 > 2

"less than" symbol: <
2 < 8

Common Errors #3: Nested Loop

```java
for (int a=1; a<4; a=a+1)
{
    for (int b=10; b<50; b=b+10)
    {
        System.out.println(a + "", " + b);
    }
}
```
public class Test {
    private static void foo(int a) {
        a = 33;
        int b = 44;
    }

    public static void main(String[] args) {
        int a = 1;
        int b = 2;
        foo(a);
        System.out.print(a + " , " + b);
    }
}

foo's a & b are in different memory locations from main's a & b.

Quiz: CS-152 Coding Standard

Which lettered line does NOT follow the standard?

{ if (x < 4) a++;
    char c = myStr.charAt(a);
    a: if (c == '+')
        { x=a+b;
            b++;
        b: }
    c: else if (c == '*') x = a*b;
    d: }
    else if (x == 4) x = b*b;
    e: else if (x > 9) x = b*b;
Exam Question

Rewrite the code segment below using correct indentation?

```java
{ if (x < 4) a++;
  char c = inStr[i];
  if (c == '+')
  { x=a+b;
    b++;
  }
  else if (c == '*') x = a*b;
  }
else if (x == 4) x = b*b;
else if (x > 9) x = b*b;
```

On an exam question, unless you are specifically required to use correct indentation or other standard, then you will not be graded on coding standards.

Fall 2010
Midterm Question #1

```java
public static void main(String[] args)
{
    int x=1;  int y=7;
    if (x+y < x*y)
    { System.out.print("B");
    }
    if (x > 5)
    { System.out.print("E");
    }
    else if (y > 0)
    { System.out.print("A");
    }
    else
    { System.out.print("T");
    }
    if (x+x > y+y)
    { System.out.print("S");
    }
    System.out.println("\n");
}
```

Output:
A

Only newline printed. This line is reached regardless of other flow.
public static void main(String[] args) {
    int x=2;  int y=3;
    if (x+y < x*y) {
        System.out.print("B");
    }
    if (x > 0) {
        System.out.print("E");
    } else if (y > 0) {
        System.out.print("A");
    } else if (y+x > 3) {
        System.out.print("T");
    } if (x+x < y+y) {
        System.out.print("S");
    } else {
        System.out.print("Y");
    }
}

Output: BES

On the exam, exact formatting is not important: Full Credit answers would include:
B E S

Spring 2011
Midterm Question #1

1) int r = 244; int g = 111; int b = 27;
2) if (r > 200) {
    System.out.print("R");
} else if (g > 200) {
    System.out.print("G");
} else if (b > 200) {
    System.out.print("B");
} if (r + g > 300) {
    System.out.print("Y");
} else if (r + b > 300) {
    System.out.print("P");
} else if (g + b > 300) {
    System.out.print("T");
} else if (r > g + b) {
    System.out.print("O");
}

Output: RY

Spring 2012
Midterm Question #1
Quiz: **if, & else if**

```java
public static void main(String[] args) {
    int x = 15;
    if (x > 20) {
        System.out.print("A");
    } else if (x > 10) {
        System.out.print("B");
    } else if (x > 5) {
        System.out.print("C");
    }
    if (x > 0) System.out.println("D");
}
```

The output is:

- a) ABCD
- b) BCD
- c) BD
- d) CD
- e) B

---

Question 2: **Top Level Structure**

```java
int a = 10;
if (a % 7 == 0) {
    ... 
} else {
    ... 
}
System.out.println("C");
if (a % 7 == 0) {
    ... 
} else {
    ... 
}
System.out.println(a);
```
1. `int a = 10;`
2. `if (a % 7 == 0)`
3. `{ System.out.println("A");
4.  a+=2;
5. }
6. `else`
7. `{ System.out.println("B");
8.  a+=4; //a = a + 4;
9. }
10. `System.out.println("C");`

State of program at end of line 10:

Question 2: Blocks 1, 2 & 3

1. `if (a % 7 == 0)`
2. `{ System.out.println("D");
3.  a+=3;
4. }
5. `else`
6. `{ System.out.println("E");
7.  if (a > 5)
8.  `{ System.out.println("F");
9.  a +=4;
10. }
11. `else`
12. `{ System.out.println("G");
13.  a -=4;
14. }
15. `System.out.println(a);`
Quiz: Which is the Inner \textbf{for} statement?

Picture myPic = \textbf{new} Picture(200, 200);
int c = 1;
\textbf{for} (int x=0; x<200; x=x+c)
{
    c = c + 1;
    // What for loop goes here?
    \{ myPic.setColor(x,y,Color.GREEN); 
    \}
}\)
\a) for (int y=x; y<200; y++)
\b) for (int y=x; y<200; y=y+c)
\c) for (int y=c; y<200; y=y+c)
\d) for (int y=x; y<c; y++)
\e) for (int y=x; y<c; y=y+c)

Full Program for Drawing Lines 1

\begin{verbatim}
import java.awt.Color;
public class Test
{
    public static void main(String[] args)
    {
        Picture myPic = \textbf{new} Picture(200, 200);
        int c = 1;
        \textbf{for} (int x=0; x<200; x=x+c)
        {
            c = c + 1;
            \textbf{for} (int y=x; y<200; y++)
            \{ myPic.setColor(x,y,Color.GREEN); 
            \}
        myPic.repaint();
    }
}\end{verbatim}
Full Program for Drawing Lines 2

```java
import javax.swing.JApplet;
import java.awt.Color;
import java.awt.Graphics;

public class Tmp extends JApplet
{
    public void paint(Graphics graph)
    {
        this.setSize(150, 150);
        graph.setColor(Color.BLUE);
        for (int b=0; b<150; b=b+10)
        {
            for (int a=b/2; a<150-(b/2); a++)
            {
                graph.fillRect(a, b, 1, 1);
            }
        }
    }
}
```

Midterm Problem #5: getGCF(28, 8)

```java
public static int getGCF(int a, int b) {
    if (a > b) {
        int tmp = a;   a = b;   b = tmp;
    }

    for (int i=a; i>=2; i--)
    {
        int r1 = a % i;
        int r2 = b % i;
        System.out.println(i+" r1="+r1 +", r2="+r2);
        if ((r1 == 0) && (r2 == 0)) {
            return i;
        }
    }
    return 1;
}
```
#8 Final Exam of Spring 2012

1) public static void main(String[] args) {
2)   Picture myPic = new Picture(201, 201);
3)   Graphics canvas = myPic.getOffScreenGraphics();
4)   canvas.setColor(Color.RED);
5)   for (int n=175; n>10; n-=25) {
6)     for (int i=-2; i<=2; i++) {
7)       canvas.drawLine(n, 10, n-i*5, n-10);
8)     }
9)     canvas.drawLine(n, 10, n, n+10);
10)   }
11) }

#8: Example Full Credit Sketches

Points I looked to confirm:
- Between 4 and 8 separate structures.
- Structures get larger left to right
- Each structure is five lines radiating downward from a single point.
- Each structure's starting point is near the top of the window.
- Structures are symmetrical with two lines on each side of a center line.
- Center line is longer than other four lines.
Center line in each "tree" must be longer than the other four lines. Too sloppy:
- Did this student know the center line was supposed to be longer?
- Did this student know that each structure is symmetrical?

There should be 7 "trees" but showing 5 is enough.
The student has -3 because only the center line gets longer.
Each tree gets full marks, but only showing two causes me to think the student does not understand loop nesting.
The -6 example may just be a lack of carefulness since many important elements are present: Separate structures with lines radiating from the top, and increasing in size. Also, the vertical line is the longest in each structure. This student finished this exam with over 45 minutes (of 2 hours) remaining.

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Quiz: *if* Logic

Which *if* statement can NEVER be true?

a) if ((a>80) && (b>80) && (a+b>150))

b) if ((a>80) && (a<150) && (b>150))

c) if ((a>150) && (a<80) && (b>80))

d) if ((a>80) && (b>80) && (a<170) && (b<170))

e) if ((a>99) && (b>99) && (a<200) && (b<200))
Wen Jung wants to write a Java program that draws the red and blue grid shown on the right. *Her program compiles.*

When **run** the program throws the exception: 

```java
java.lang.NullPointerException
```

Goal:

```
1) import java.awt.Color;
2) public class IHaveARunTimeError
3) {
4)     private static Picture myPic;
5)     private static void drawLines(boolean vertical, Color c)
6)     {
7)         for (int a = 0; a < myPic.getImageWidth(); a = a + 10)
8)             for (int b = 0; b < myPic.getImageWidth(); b++)
9)                 if (vertical) myPic.setColor(a, b, c);
10)                else myPic.setColor(b, a, c);
11)                myPic.repaint();
12)                try { Thread.sleep(10); } // Remove this when done testing
13)            }
14)        }
15)    }
16) }
17) }
18) public static void main(String[] args)
19) {
20)     Picture myPic = new Picture(200, 200);
21)     drawLines(true, Color.GREEN);
22)     drawLines(false, Color.RED);
23) }
```

Facts:
- Program compiled (no syntax errors)
- Program crashed with Null pointer Exception.
Midterm Problem 8: Common Incorrect Responses

Line 9) if (vertical) p =... should be if (vertical == true)

Line 4) Picture cannot be declared private and used in drawLines

Line 5) Remove void from void drawLines

Line 8) .getWidth() should be .getHeight() (why does this algorithm depend on the image being square?)

Spring 2013 Midterm Results

Grade Histogram

Score Range

[0,10) [10,20) [20,30) [30,40) [40,50) [50,60) [60,70) [70,80) [80,90) [90,100) [100+)

Frequency

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Serious Wake-up Call!
These folks can still pass with a good grade.
Nested Loops and conditional logic must be learned SOON!

Final Exam: 90-100 range.
The Facts

- Midterm + Final = 45% of course grade.
- No Grading Curve.
- The final will not be much different from the midterm: It will include arrays, and be slightly harder.
- If a student does better on the final than on the midterm, then the student's midterm will be dropped.
- Extra credit is applied to lab / project grade and i-clicker grade ONLY.
  - No extra credit points will be applied to the midterm.
  - Only the game/app project extra credit can be applied to the final exam. No new students may join that group. Anyone in that group who did not score 80% or above on the midterm must meet with me before continuing work on the game/app.

To Drop/Audit or Not to Drop/Audit

- You MUST learn to read nested loops and conditional logic to pass this course.
- All the projects through the rest of the semester will be much more complicated than anything on the midterm exam or on the final.
- Until you understand all the baby programs on the midterm, you will not even have a chance at being able to do the remaining projects.
- If you do not understand the baby programs on the midterm then: STUDY, GO TO EXTRA LABS, GO TO OFFICE HOURS, GO TO TUTORING or drop/audit.
Test Taking Tip for Joel's Tests:

It is likely that you are doing something wrong if:

1) You have excessive output.
2) You have no output.
3) You find yourself performing complicated arithmetic (i.e. $2.4 \div 0.7$).

When in doubt, ask....

Generally, I will tell test takers stuff such as "that is way too much output" or "you are missing a lot of output". For each student, I will generally answer one: "is my answer mostly correct"? The worst you will get from me is a meaningless shrug.

One Call, One Return

```java
1) public static int foo(int a, int b)
2) {
3)  for (int i=a; i>1; i--)
4)  {
5)    System.out.print(i + " ");
6)    if ((a % i ==0) && (b % i ==0)) return i;
7)  }
8)  return 1;
9) }
10}
```

Requires that `foo` will return **exactly one int**

Each call to `foo` MUST reach a `return int` statement.
NEVER will a call to `foo` reach more than one `return int`. 
System.out.println(String msg)

1) public class Tmp
2) {
3)    public static int foo(int a, int b)
4)    { for (int i=a; i>1; i--)
5)        { System.out.print(i + " ");
6)            if ((a % i == 0) && (b % i == 0)) return i;
7)        }
8)    return 1;
9) }
10)
11) public static void main(String[] args)
12) {
13)    int a=5, b=6, c=15;
14)    System.out.println("foo=\n" + foo(a,c));
15)    System.out.println("foo=\n" + foo(a,b));
16)    System.out.println("foo=\n" + foo(b,c));
17) }
18} }

Nested Loop Example

1) public static void main(String[] args)
2) {
3)    for (int i=0; i<20; i=i+5)
4)    {
5)        System.out.print("i=\" + i + ", k=\" + [\);
6)        for (int k=0; k<=i; k++)
7)        {
8)            System.out.print(" " + k);
9)        }
10)     System.out.println(" ]");
11)    }
12) }

i=0, k= [ 0 ]
i=5, k= [ 0 1 2 3 4 5 ]
i=10, k= [ 0 1 2 3 4 5 6 7 8 9 10 ]
i=15, k= [ 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 ]