CS-259
Computer Programming Fundamentals
Midterm Exam

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Up Coming Schedule

Midterm Exam: Wednesday, Oct 7
Fall Break: Thurs, Friday Oct 8 & 9
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); }
}
```
**Common Errors #4: Local Fields**

```java
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-259 Coding Standard**

Which **lettered line** does NOT follow the standard?

```java
{ 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 your are specifically required to use correct indentation or other standard, then you will not be graded on coding standards.
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
B E S

int r = 244; int g = 111; int b = 27;
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");
} if (r > g + b) {
    System.out.print("Q");
} 

Output: RY
Quiz: *if*, & *else if*

1) public static void main(String[] args)
2) {
3)     int x = 15;
4)     if (x > 20)
5)         { System.out.print("A");
6)     }
7)     else if (x > 10)
8)         { System.out.print("B");
9)     }
10)    else if (x > 5)
11)     { System.out.print("C");
12)    }
13)    if (x > 0) System.out.println("D");
14) }

The output is:
   a) ABCD      b) BCD      c) BD      d) CD      e) B

Question 2: Top Level Structure

1) int a = 10;
2) if (a % 7 == 0) { ... }
   else { ... }
3) System.out.println("C");
4) if (a % 7 == 0) { ... }
   else { ... }
5) System.out.println(a);
Question 2: Blocks 1, 2 & 3

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

State of program at end of line 10:

Question 2: Blocks 4 & 5

11. if (a % 7 == 0) {
12. System.out.println("D");
13. a+=3;
14. }
15. else {
16. System.out.println("E");
17. if (a > 5) {
18. System.out.println("F");
19. a +=4;
20. }
21. else {
22. System.out.println("G");
23. a -=4;
24. }
25. }
26. System.out.println(a);
Quiz: Which is the Inner \textbf{for} statement?

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

\begin{enumerate}
\item a) for (int y=x; y<200; y++)
\item b) for (int y=x; y<200; y=y+c)
\item c) for (int y=c; y<200; y=y+c)
\item d) for (int y=x; y<c; y++)
\item e) for (int y=x; y<c; y=y+c)
\end{enumerate}

Full Program for Drawing Lines 1

import java.awt.Color;
public class Test
{
  public static void main(String[] args)
  {
    Picture myPic = \texttt{new Picture(200, 200)};
    int c = 1;
    \texttt{for (int x=0; x<200; x=x+c)}
    {
      c = c + 1;
      \texttt{for (int y=x; y<200; y++)}
      {
        myPic.setColor(x,y,Color.GREEN);
      }
    }
    myPic.repaint();
  }
}
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) {
3)   Picture myPic = new Picture(201, 201);
4)   Graphics canvas = myPic.getOffScreenGraphics();
5)   canvas.setColor(Color.RED);
6)   for (int n=175; n>10; n-=25)
7)     {
8)       for (int i=-2; i<=2; i++)
9)         {
10)          canvas.drawLine(
11)              n, 10, n-i*5, n-10);
12)         }
13)     canvas.drawLine(n, 10, n, n+10);
14)   }
15) }

#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.
#8: Partial Credit Examples 1 of 3

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?

#8: Partial Credit Examples 2 of 3

- 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 remaining (of the total 2 hours).

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:**

```java
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)     }
13)     try { Thread.sleep(10); } // Facts:
14)     catch (InterruptedException e) { }
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) }
24)```
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?)

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 preforming complicated arithmetic (i.e. 2.4 ÷ 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
public static int foo(int a, int b) {
    for (int i=a; i>1; i--)
        System.out.print(i + " ");
    if ((a % i ==0)&&(b % i ==0)) return i;
    return 1;
}
```

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)

```java
public class Tmp {
    public static int foo(int a, int b) {
        for (int i=a; i>1; i--)
            System.out.print(i + " ");
        if ((a % i == 0) && (b % i == 0)) return i;
    }
    public static void main(String[] args) {
        int a=5, b=6, c=15;
        System.out.println("foo=" + foo(a,c));
        System.out.println("foo=" + foo(a,b));
        System.out.println("foo=" + foo(b,c));
    }
}
```

Argument is evaluated `before` `println` method is called.

5 `foo=5`
5 4 3 2 `foo=1`
6 5 4 3 `foo=3`
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("这种 "+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 ]