Midterm

- Friday, October 31, 11:00 AM
- In class
- Closed book
- Chapters 1-4, 11, and Section 5.5 (Interfaces)
- Anything from readings and assignments

Midterm Topics

- Java syntax
- Java control flow and expression evaluation
- Java data types
- Java classes and methods
- Interfaces
- Recursion
- Number base conversion
Midterm Question Format

- Multiple choice questions
- Programming questions
- Calculation questions

Example Questions

Of the following types, which one cannot store a numeric value?

a) byte
b) float

[Circle c) boolean]
d) int
Example Questions

If x is an int and y is a float, which one of the following is not a legal assignment statement?

a) $y = x$;

b) $x = y$;

c) $y = \text{(float)} \ x$;

d) $x = \text{(int)} \ y$;

Example Questions

Assume that $x$, $y$, and $z$ are all ints equal to 50, 20, and 6. What is the value of $x / y / z$?

a) 16

b) 12

c) 0

d) A syntax error as this is syntactically invalid

e) A run-time error since this is a division by 0
Example Questions

If we have the statement

```java
String s = "Hello world";
```

What is returned by `s.charAt(1)`?

a) 'H'

b) 'e'

c) 'l'

d) "Hello"

Example Questions

Suppose you have three String variables `a`, `b`, `c`. The statement `c = a + b;` can also be achieved by:

a) `c = a.length() + b.length();`

b) `c = (int) a + (int) b;`

c) `c = a.concat(b);`

d) `c = b.concat(a);`
e) `c = String.concat(a,b);`
Example Questions

Assume that q, x, y, and z are int variables with x = 1, y = 10, z = -3. Which of the following is true after this statement is executed?

\[ q = (x++ \times y--) + ++z; \]

a) \( q == 7 \)  
b) \( q == 16 \)  
c) \( q == 22 \)  
d) \( q == 8 \)

Example Questions

Assume that q, x, y, and z are int variables. Rewrite this statement as a sequence of simple statements without the increment and decrement operators, and with at most one operation in each statement.

\[ q = (x++ \times y--) + ++z; \]

\[ q = x \times y; \]
\[ x = x + 1; \]
\[ y = y - 1; \]
\[ z = z + 1; \]
\[ q = q + z; \]
Example Questions

What value will z have after the statement:
   float z = 5 / 10;

a) 0
b) 0.5
c) 5.0
d) 2.0
e) none of the above, a compile-time error arises because z is a float and 5 / 10 is an int

Example Questions

Assume that x is an int variable with x = 1. What will be the value of x after this loop terminates? while (x < 100) x *= 2;

a) 2
b) 101
c) 64
d) 128
Example Questions

Give a recursive definition of the number of ways to draw two cards from a deck of n cards.

Base case(s):
For $n=2$, $waysToDraw(n)$ is 1

Recursive case:
For $n>2$, $waysToDraw(n)$ is

$waysToDraw(n-1) + (n-1)$

Another Recursion Question

Give a recursive definition of the number of subsets of a set with n elements (including empty set).

Base case(s):
For $n==0$, $numSubsets(n)$ is 1

Recursive case:
For $n>0$, $numSubsets(n)$ is

$numSubsets(n-1) + numSubsets(n-1)$
**Base Conversions**

Convert from binary to octal:

\[
\begin{array}{cccc}
0 & 1 & 1 & 1 & 0 & 1 & 0 \\
1 & 7 & 2
\end{array}
\]

Convert from binary to hexadecimal:

\[
\begin{array}{cccc}
0 & 1 & 1 & 1 & 0 & 1 & 0 \\
7 & A
\end{array}
\]

---

**Example Questions**

Fill in the code in a method to extract the first letter of each word in a String. A word consists just of letters. You may use the static method `Character.isLetter(ch)` which returns true if the character `ch` is a letter.

```java
String initials(String s) {

}
```
Example Questions

Extract the first letter of each word.

```java
String initials(String s) {
    String result = "";
    for (int i = 0; i < s.length(); ++i) {
        if (Character.isLetter(s.charAt(i)) &&
            (i == 0 ||
                 !Character.isLetter(s.charAt(i-1))))
            result += s.charAt(i);
    }
    return result;
}
```

Example Questions

Fill in the code for classes `Part` and `Labor` that implement the interface `Billable`.

```java
public interface Billable {
    public final NumberFormat fmt =
        NumberFormat.getCurrencyInstance();

    // Compute charge for this item
    public double charge();

    // Realize the item as a String
    public String toString();
}
```
This driver shows use of Part and Labor.

```java
public class BillTest {
    public static void main(String args[]) {
        Billable p1 = new Part("oil filter", 1, 5.95);
        Billable p2 = new Part("oil", 5, 1.79);
        Billable l = new Labor(.5, 25.00);

        double total = 0.0;
        total += p1.charge();
        total += p2.charge();
        total += l.charge();

        System.out.println("Total charge is " + 
                          Billable.fmt.format(total));
        System.out.println("Detail of bill:");
        System.out.println(p1 + "
                             + p2 + "
                             + l);
    }
}
```

Fill in all needed methods of Part.

```java
public class Part implements Billable {
    private String desc;    // Description of item
    private int quantity;   // Number of items
    private double price;   // Item price

    Part(String d, int n, double p) {
        desc = d; quantity = n; price = p;
    }

    public double charge() { return quantity * price; }

    public String toString() {
        return desc + ": " + quantity + " at " +
                fmt.format(price);
    }
}
```
Interface Question Continued..

Fill in all needed methods of `Labor`.

```java
public class Labor implements Billable {
    private double hours; // Hours of labor
    private double rate;  // Hourly labor rate

    Labor(double h, double r) {
        hours = h; rate = r;
    }

    public double charge() { return hours * rate; }

    public String toString() {
        return "Labor: " + hours + " hours at " + fmt.format(rate);
    }
}
```

Exam Strategy

- Do the multiple choice first
  - Over half of the points
  - Probably easiest
- Pace yourself
- Leave time to check your work
- Relax