CS100J Spring 2007. Answers to final

1. s= – cumprod(–1 + zeros(1, n)); % the signs
num= s .* cumprod(5 + zeros(1,n));
den= 1:n;
value= cumsum(num ./ den);

```
// postcondition: (digit sum of n) = c;
2.      int m= n;
int c= 0;
//inv: (digit sum of n) = c + (digit sum of m) and
       0 <= c < 10
while (m > 0) {
     c= c + m % 10;
     if (c >= 10)
        c= c/10 + c%10;

     m= m / 10;
```

3 }/** See final for spec */
```
public static String[] histo(int[] scores) {
   int[] b= new int[21];
   // Calculate b[0..20]. Each b[i] will contain the number
   // of times i occurs in scores.
   // inv: Each b[i] = no. of times i occurs in scores[0..k-1]
   for (int k= 0; k < scores.length; k= k+1) {
      b[scores[k]]= b[scores[k]] + 1;
   }

   String[] result= new String[21];
   //invariant: result[0..k-1] has their final values
   for (int j= 0; j < b.length; j= j+1) {
     // Create result[k]
     result[j]= (j < 10 ? "0" : "") + j + " ";
     for (int n= 0; n < b[j]; n= n+1) {
        result[j]= result[j] + "*";
     }
   }

   return result;
}
```

4. CS100 Blues - Gries : 9.0
CS100 Blues - Gries : 9.0
Help! - Student : 10.0
Sound@c9ce70
Help! - Student : 10.0
Length of sound: 59.0
The author is: Gries
ERROR
The songs have the same author?false
The songs have the same author?true

5. Note that in this case we put the base case last simply because testing for the base case doesn't have to be done then.

```
/** = value of expression e. */
public static int eval(Exp e) {
  if (e.n.equals("+"))
    return eval(e.left) + eval(e.right);

  if (e.n.equals("-"))
    return eval(e.left) - eval(e.right);

  if (e.n.equals("*"))
    return eval(e.left) * eval(e.right);

  return Integer.parseInt(e.n);
}
```

6. (a) body of constructor:
```
super(n,p,s);
canLaugh= b;
```

body of equals:
```
if (!(ob instanceof BabyDoll))
   return false;

BabyDoll bd= (BabyDoll) ob;

return
   ob.getName().equals(getName()) &&
   ob.getPrice() == getPrice() &&
   ob.getSeller().equals(getSeller()) &&
   ob.canLaugh == canLaugh;
```

(b) Apparent class: `Doll`. Real class: `BabyDoll`.

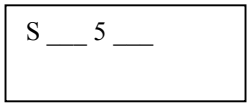
(c)
```
public class BarbieDoll extends Doll {
   private String hairColor;  // hair color
   private String style;     // Style of clothes

   /** Constructor: a BarbieDoll with name n, price p,
       seller s, hair color hc, and clothing style cs */
   public BarbieDoll(String n, double p, String s,
                     String hc, String cs) {
      super(n, p, s);
      hairColor= hc;
      style= cs;
   }

   /** = hair color */
   public String getHairColor()
      { return hairColor; }

   /** = clothing style */
   public String getStyle()
      { return style; }

   /** String representation of this BarbieDoll*/
   public String toString(){
      return super.toString() +
             ",Hair color: " + hairColor +
             ",Style: " + getStyle();
   }
}
```

7. (a) If `b` contains the name of an object of class `Object`, with no subclasses, then `b.equals(ob)` is the same as `b == ob`.

(b) super();

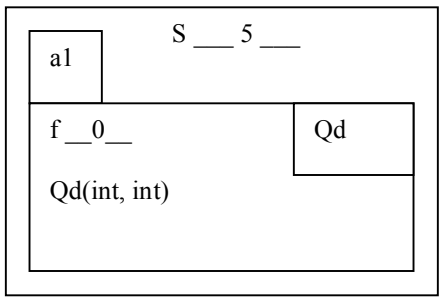
(c) this evaluates to the name of the object in which it occurs.

(d)

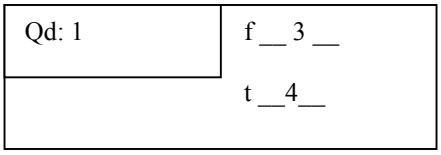


Steps in evaluating **new** Qd(3, 4):

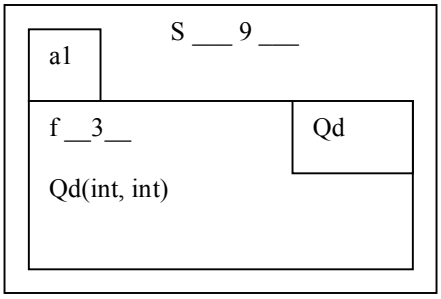
1. Draw an object of class Qs (and put it in the file drawer)



2. Execute the constructor call Qd(3, 4). Here is the frame for the call:



and after execution, the object and the file drawer look like this:



3. The value of the new expression is: the name a1.

8. Algorithm Partition. We give assertions as formulas; you can translate them easily into diagrams.

```
/** Given a value x in b[p], partition b[p..q-1] and store a
      value in local variable j so that
      b[p..j-1] <= x = b[j] <= b[j+1..q-1].
      Then return j. */
public static int partition(int[] b, int p, int q) {
  int j= p;
  int k= q;
  // inv: b[p..j-1] <= x = b[j] <= b[k..q-1]
  while (j+1 != k) {
    if (b[j+1] <= b[j]) {
      Swap b[j] and b[j+1];   j= j+1;
    } else {
      k= k–1;   Swap b[k] and b[j+1]
    }
  }
  return j;
}
```