CS 100J Prelim 2 Spring 2007 Answers

Question 1. (a) A loop invariant is a true-false statement that is true before and after each iteration of the loop.

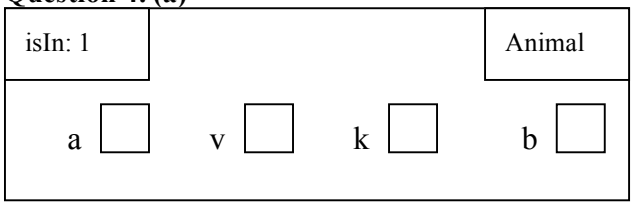
(b)
```
int m= f(0);
    // invariant: m = maximum value of f(i) for
                  i in the range 0..k–1
    for (int k= 1; k < n; k= k+1) {
        m= Math.max(m, f(k));
    }
```

Question 2.
```
/** Pts in v[0..k-1] with negative x-y-coords
    have been replaced by corres. pts
    with positive x-y-coords. */
for (int k= 0; k < v.size(); k= k+1) {
  if (v.get(k).getX() < 0 && v.get(k).getY() < 0){
    int x= Math.abs(v.get(k).getX());
    int y= Math.abs(v.get(k).getY());
    v.set(k, new Point(x, y));
  }
}
/** Pts in v[0..v.size()-1] with negative x-y-coords
    have been replaced by corres. pts with positive
    x-y-coords. */
```

Question 3. **(a)** The apparent type of a variable is the type or class with which it is declared; its real type is the type or class of the object whose name it contains. Variable v has apparent class Animal and real class AsianElephant.

(c) (1) false, (2) "Elephant", (3) Run-time error: the Elephant cannot be cast to class AsianElephant. (4) Compiletime (syntactic) error: The apparent type of f, Animal, does not have a getHeight() method.

Question 4. (a)



(b)
```
/** = "obj is an Elephant with the same values
      in its fields as this Elephant" */
public boolean equals(Object obj) {
    if (!(obj instanceof Elephant))
        return false;
    Elephant e= (Elephant) obj;
    return ht == e.ht &&
           getName().equals(e.getName()) &&
           getWeight() == e.getWeight();
}
```

Question 5.
```
/** = Rhino ra and rb are related */
public static boolean areRelated (
                          Rhino ra, Rhino rb) {
    if (ra == null || rb == null)
        return false;
    if (ra == rb)
        return true;
    // ra and rb are not null and are different
    return areRelated(ra, rb.mother) ||
           areRelated(ra, rb.father) ||
           areRelated(rb, ra.mother) ||
           areRelated(rb, ra.father);
}
```

Question 3. (b)