CS312 Credit by Exam Sample 1 - Suggested Solution and Grading Criteria.
Grading acronyms:
AIOBE - Array Index out of Bounds Exception may occur
NPE - Null Pointer Exception may occur
OBOE - Off by one error. Calculation is off by one.

1. Expressions - 1 point each. -1 for missing or extra " OR .0. differences in capitalization of `true` and `false` okay. No limit on points off.

A. `5`
B. `17`
C. `false`
D `'D'`
E. `""`
F. `true`
G. `false (always false due to Math.random() return values.)`
H. `5.6`
I. `"9RING55"`
J. `5`

2. Code Tracing - 1 point each. Answer as shown or -1. -1 for first four occurrences of "'s. Differences in spacing, commas, and grouping symbols okay for array output.

A. `[3, 4, 8]`
B. `[4, 0, 2]`
C. `[0, 0, 0, 0]`
D `[1, 3, 5, 12, 9]`
E. `0 [F, E, GC]`
F. `4 8 0.0`
G. `false`
H. `[1, 10, 4]`
I. `[0, 1, 5, 12, 0]`
J. `RUNTIME ERROR (Due to / by 0)`
K. `5 [0, 2] 7`
L. `INFINITE LOOP (due to boolean expression in while loop never equaling false.)`
M. `.5 each`
`syntax error (no constructor for PC that takes an int)`
`legal`
N. `.5 each`
`syntax error (Computer not a subtype of MAC)`
`syntax error (Mac not a subtype of PC)`
O. `8 4`
P. `10`
Q. `SYNTAX ERROR (cp's declared type is Computer which does not have a getColors method.)`
R. `10`
S. `false false`
T. `16`
U. `true`
V. `Because we don't have access to the private instance variable memory OR words to that affect. (Including no variable named memory in scope.)`

3. Critters - 16 Points. Yak class

```
public class Yak extends Critter {
    private static Direction[] dirs = Direction.values();
    private Direction dir;
    private int maxSteps;
    private int steps;

    public Yak () {
        dir = getRandomDirection();
        maxSteps = 1;
    }

    private Direction getRandomDirection() {
        int index = (int) (Math.random() * 4);
        return dirs[index];
    }

    public boolean eat() { return true; }

    public Direction move() {
        Direction result = dir;
        steps++;
        if (steps == maxSteps) {
            steps = 0;
            maxSteps++;
            dir = getRandomDirection();
        }
        return result;
    }

    public Attack fight(String opp) {
        Attack result = Attack.ROAR;
        if (dir == Direction.EAST || dir == Direction.WEST) {
            result = Attack.POUNCE;
        }
        return result;
    }
}
```

Points:

header correct with extends clause: 1 point
instance variables: 1 point (can be different, but must track steps, leg length and current direction)
instance vars private: 1 point
correctly picks random direction, 2 points
eat overridden correctly: 1 point
fight method:
- check correct next direction and return correct value 4 points
- -4 if call getMove in fight

getMove
- correctly handles incrementing steps this leg and direction to return, 2 points
- correctly handles case when end of leg reached and steps, leg length, and direction updated, 4 points

Other Deductions:
-6 loop in getMove method / trying to move multiple times in getMove

4. Data Processing and Arrays- 17 Points.

```
public static boolean capitalLettersPresent(Scanner sc,
                                            int[] required) {
    while (sc.hasNext()) {
        String s = sc.next();
        for (int i = 0; i < s.length(); i++) {
            char ch = s.charAt(i);
            if ('A' <= ch && ch <= 'Z') {
                int index = ch - 'A';
                if (required[index] > 0) {
                      // if check not required in soln's
                    required[index]--;
                }
            }
        }
    }
    // now check that all values are 0
    for (int numLeft : required) {
        if (numLeft > 0) {
            return false;
        }
    }
    // All zeros.
    return true;
}
```

- correctly loop while hasNext true for Scanner, 2 points
- get next token from Scanner, 2 points
- loop through all characters of token, 2 points
- correctly check that current char is a capital letter, 4 points
- correctly update counter for given letter, 3 points
- after reading all tokens, correctly check if any counters > 0 and return false, 3 points
- return true (or correct answer if requirements met), 1 point

Other Deductions:
-4 loop through String of capital letters or use indexOf instead of mapping
-4 scanner loop on inside of some other loop, attempting to scan file multiple times
-3 concat to create new String version of input
-2 convert input to upper case

5. Arrays 16 Points.

```
    public static int[] copyWithOutRange(int[] vals, int start, int stop)
{
        int newLen = vals.length - (stop - start);
        int[] result = new int[newLen];
        // copy elements up to index start in vals
        for (int i = 0; i < start; i++) {
            result[i] = vals[i];
        }
        // copy elements from index stop to end of vals;
        int indexResult = start;
        for (int i = stop; i < vals.length; i++) {
            result[indexResult] = vals[i];
            indexResult++;
        }
        return result;
    }
```

- creating resulting array of correct size: 2 points
- correctly add elements up to index start to result, 4 points
- loop to add elements from stop to end of original array to result, 4 points
- index correct for resulting array, 4 points
- return result, 2 point

Other Deductions:
-4 return original array (vals) if no elements removed (instead of making copy)
-4 for altering values in the parameter vals
-2 one loop, with if statement, possibly very inefficient if most elements removed.

6. Arrays and Objects. 17 Points.

```
public static double minDistance(Point[] pts) {

    double min = pts[0].distance(pts[1]);
    for (int i = 0; i < pts.length; i++) {
        Point p1 = pts[i];
        for (int j = i + 1; j < pts.length; j++) {
            Point p2 = pts[j];
            double distance = p1.distance(p2);
            if (distance < min) {
                min = distance;
                /* Stop if hit 0. Questionable if this is
                   worthwhile. Certainly not required. */
                if (min == 0.0) {
                    return 0.0; // can't do better than that
                }
            }
        }
    }
    return min;
}
```

- variable for min distance of type double, 1 point
- correctly initialize min distance to distance between first two Points or Double.MAX_VALUE. Also okay to use flag for first time. (Gacky) Lose this if use Integer.MAX_VALUE or some arbitraty value, 2 points
- outer loop correct for all Points, 3 points (okay if subtract 1 from length)
- inner loop correct with bounds so we check all Points after current Point based on outer loop, 5 points
    - lose if check all Points
    - -2 efficiency if check all Points but guard with if
- correctly access Point objects from array, 1 point
- correctly calculate distance using distance method, 2 points
- correctly check if current distance less than min so far and update distance, 2 points
- return correct result, 1 point (not necessary for min = 0.0 check.)

Other Deductions:
-7 no inner loop /only check adjacent pairs

7. ArrayList - 16 points

```
public static int removeStrings(Scanner sc, ArrayList<String> list) {
    int count = 0;
    while (sc.hasNext()) {
        String s = sc.next();
        boolean search = true;
        int i = 0;
        while (i < list.size() && search) {
            if (list.get(i).equals(s)) {
                search = false;
                list.remove(i);
                count++;
            }
            i++;
        }
    }
    return count;
}
```

- counter for number removed: 1 point
- while loop correct for Scanner (hasNext or hasNextLine): 2 points
- get next token: 1 point
- loop for elements on ArrayList, 3 points
- stop when find first occurrence, 2 points (-1 if use boolean, but loop through whole list)
- use size method and get method for ArrayList, 2 points (1 each)
- use equals method from String class, 2 points
- remove from list and increment counter if matches, 2 points (1 each)
- returns correct result, 1 point

Other Deductions:
-5 swapped loop, main Scanner loop inside a loop for elements in list,
-5 removing multiple or all elements from list on first occurrence of word
-4 treating list like an array, [index] instead of get(index)
-4 using indexOf or contains methods for ArrayList

8. 2D Arrays - 16 points

```
public static void clampValue(int[][] mat, int r, int c, int w, int h, int tgt)
{     int startRow = r - h + 1;
      if (startRow < 0) {
            startRow = 0;
      }
      int startCol = c - w + 1;
      if (startCol < 0) {
            startCol = 0;
      }
      for (int row = startRow; row <= r; row++) {
            for (int col = startCol; col <= c; col++) {
                  if (mat[row][col] < tgt) {
                        mat[row][col] = tgt;
                  }
            }
      }
}
      // alternate solution with while loops
     public void clampValues(int[][] mat, int r, int c,
             int w, int h, int tgt) {
         int row = r;
         int endRow = r - h + 1;
         int endCol = col - w + 1;
         while (row >= 0 && row >= endRow) {
             int col = c;
             while (col >= 0 && col >= endCol) {
                 if (mat[r][c] < tgt) {
                     mat[r][c] = tgt;
                 }
                 col++;
             }
             row++;
         }
     }
```

- nested loop, 3 points
- bounds check row correctly, 3 points
- bounds check column correctly, 3 points
- treat r, c as lower right corner, 2 points
- access array elements correctly, 1 point
- check if element less than target and set if necessary, 3 points
- don't perform unnecessary checks, 1 point

Other Deductions:
disallowed methods, -5 points off
AIOBE, -4
OBOE, first -2, second and subsequent, -1
infinite loop, -6