BME506/COE318 QUIZ

Examiners: Profs. E. Bagheri, K. Clowes, O. Das, T. Yang Time: 50 minutes

Answer all questions on this exam paper

Circle your professor's name.

Name: _____ **Student ID #:** _____

Closed book.

No PDA's, cell phones, calculators, tablets, laptops, desktops or mainframe computers allowed.

No Wi-Fi, bluetooth, zigbee, infrared, ultraviolet, radioactive, quantum entangled state, 3G, LTE or any other wireless connection.

(After inspection, you may be allowed an abacus or slide rule, but not both!)

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1. Given the following class:

```
public class Id {
  private int id;

  public Id(int i) {
    id = i;
  }

  public static void main(String[] args) {
    int j, k;
    Id[] ids;
    ids = new Id[3];

    for (j = 0; j < 3; j++) {
      ids[j] = new Id(j + 1);
       System.out.println(ids[j].id);
    }

    for (k = 2; k >= 0; k--) {
      ids[k] = ids[(k + 1) % 3];
    }
    System.out.println(ids[0].id);
    System.out.println(ids[1].id);
    System.out.println(ids[2].id);
    System.out.println(j);
    System.out.println(k);
  }
}
```

What is the output when the main method is executed?

```
1
2
3
1
1
1
3
-1
```

2. A capacitor (C) stores electrical charge (Q) and has a voltage (V) across it. These are related with the equation $Q=CV$. Furthermore, the energy (E) stored in the capacitor is $E=\frac{1}{2}CV^2$. The following class is a partial implementation of a model of a Capacitor:

```
public class Capacitor {
  //Do NOT add any other instance variables
  //Do NOT change the name or meaning of these
  private double c;   //Capacitance (C)
  private double q = 0;  //Charge (Q)

  public Capacitor(double cap) {
    c = cap;
  }
  public double getCharge() {
    return q;
  }
  public double getCapacitance() {
    return c;
  }
  public double getVoltage() {
  //IMPLEMENT THIS METHOD

    return q/c;



 }
  public void setCharge(double charge) {
    q = charge;
  }
```

```
    public void setVoltage(double v) {
    //IMPLEMENT THIS METHOD

      q = c*v;

    }
    public double getEnergy() {
       //IMPLEMENT THIS METHOD

      double v = getVoltage();
      return (1/2) * c * v * v;

    }
  }
```

Complete the missing methods (getVoltage, setVoltage, getEnergy).

3. A vector in 3-dimensional space is partially implemented in the following class. The dot product (to be implemented by the `dotProduct(Vector3D other)` method is defined as follows:

   If $\vec{p}$ has components (a, b, c) and $\vec{q}$ has components (d, e, f) then the dot product between p and q is $\vec{p}\cdot\vec{q} = a\cdot d + b\cdot e + c\cdot f$.

```
  public class Vector3D {

    private double x;
    private double y;
    private double z;

    public Vector3D(double a, double b, double c) {
      x = a;
      y = b;
      z = c;
    }
```

```
  public Vector3D crossProduct(Vector3D other) {
    return new Vector3D(y * other.z - z * other.y,
            -x * other.z + z * other.x,
            x * other.y - y * other.x);
  }
  public double dotProduct(Vector3D other) {
//Implement this method

    return (x * other.x) + (y * other.y) + (z * other.z);

  }

  public String toString() {
    return x + "i + " + y + "j + " + z + "k";
  }

  public static void main(String[] args) {
    Vector3D p, q, w;
    p = new Vector3D(1, 0, 0);
    System.out.println("p: " + p.toString());
    q = new Vector3D(0, 1, 0);
    System.out.println("q: " + q.toString());
    w = p.crossProduct(q);
    System.out.println("p x q: " + w.toString());
  }
}
```

i. What is the output when main is run?

```
p: 1.0i + 0.0j + 0.0k
q: 0.0i + 1.0j + 0.0k
p x q: 0.0i + 0.0j + 1.0k
```

ii. Implement the dotProduct method.