Section, Name and ID#

AMERICAN UNIVERSITY OF ARMENIA
College of Science and Engineering
CS 120 Introduction to Object-Oriented Programming
MIDTERM EXAM

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see TT

Date / Time: Friday, March 17 2017 at 17:30
Duration: 2 hours
Attention: **ANY TYPE OF COMMUNICATION IS STRICTLY PROHIBITED**
Write down your section, name and ID# at the top of all used pages

Participation:

Problem 1: Consider below a C++ function ***float kahan(float num1, float num2, float& compensation)*** that implements the ***Kahan Summation Algorithm*** for high-precision compensated summation of two float arguments ***float num1*** and ***float num2***:

```
float kahan(float num1, float num2, float &compensation)
{
    float result;
    num2 -= compensation;
    result = num1 + num2;
    compensation = (result - num1) - num2;
    return result;
}
```

Using this function, write a C++ function ***float e(int n)*** that computes the value ***e*** by the following formula:

$$e = \sum_{k=0}^{n} \frac{1}{k!} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1*2} + \frac{1}{1*2*3} + \cdots$$

Recall that the factorial of non-positive numbers equals to ***1*** by definition.

The initial value of ***float compensation*** is ***0.0***.

```
float e(int n){
float ans = 0;
for(int c=1; c<n+1; c++){
int num=1
for(int b=1; b<c; b++){
    num *= b
}
ans = kahan(ans, 1/num, comp);
return ans;
}
```

Use the backside, if needed

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Problem 2: Write a Java method ***public static double[] mean(double[] data)*** that takes as its argument an array of data points ***double[] data***, and returns a two-element array – the first element being the mean value of the data points and the second element being the standard deviation. The standard deviation σ of n numbers a_i is computed as:

$$\sigma = \sqrt{\frac{\sum_{i=0}^{n-1}(a_i - mean)^2}{n}}$$

```
public static double [] mean(double[] data)

double mean=0;
double sum=0;
    int length= data.length;
for (int bb=0; bb<length, bb++){
                sum += data[bb]};

mean= sum/length
double top=0;
double ans=0;
for(int bb=0; bb <length; bb++){
    top+= (data[bb]-mean)* (data[bb]mean);}
ans=Math.sqrt(top/length);
return (new double[] {mean; ans});
}
```

Use the backside, if needed

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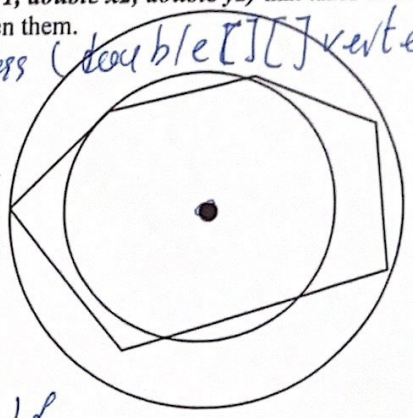
Problem 3: Write a Java function ***public static double thickness(double[][] vertex)*** that takes as its argument a ***2-by-n*** array of polygon's vertex coordinates ***double[][] vertex*** – the ***x*** coordinates in the first row and ***y*** coordinates in the second row. It returns polygon's boundary thickness as follows:

1. Computes the center – the mean ***x*** and ***y*** vertex coordinates;
2. Returns the difference between the maximal and minimal distances from the center to the vertices.

You may assume and use a method ***double dist(double x1, double y1, double x2, double y2)*** that takes as its arguments coordinates of two points and returns the distance between them.



```
public static double thickness (double[][] vertex)
    int length = double[0] length
        double centerx = 0.
        double centery = 0.
for(int bb = 0, bb < length, b++){
    centerxx = vertex[0][bb];
    centeryy = vertex[1][bb];
}
centerx = centrex/length;
centry = centreyl/length;
double min = dist(vertex[0][0]);
double max = min
for(int bb = 1; bb < lengt, b bt+){
double mean dist = vertex[0][1]
if local distance > max{
    max = local dist;
}
if mean dist < min { = local dist;}
    return max - min;
```

Use the backside, if needed

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