AMERICAN UNIVERSITY OF ARMENIA

College of Science and Engineering

CS 120 Introduction to Object-Oriented Programming

MIDTERM EXAM

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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 pi(int n)*** that computes the value π by the following formula:

$$\pi = 2\sum_{k=0}^{n}\frac{(2k-1)!!}{(2k)!!(2k+1)} = \frac{2}{1*1}+\frac{1}{2}*\frac{2}{3}+\frac{1*3}{2*4}*\frac{2}{5}+\frac{1*3*5}{2*4*6}*\frac{2}{7}+\cdots$$

Recall that **n!!** is the product of odd numbers from *1* to ***n***, if ***n*** is odd; and is the product of even numbers from *2* to ***n***, if ***n*** is even. The double factorial of non-positive numbers equals to *1* by definition.

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

float pi(int n)

float floatodd int n) {

result1 = 1; result2 = 1;

for (i = 2, i <= n, i = i + 2)

result1 = result1 * i;

floatodd(int n)

for (j = 1, j <= n, j = j + 2)

result2 = result2 * j;

pi = 2 * odd(2k-1) / (even(2k) * (2k+1))

wrong logic

return pi;

}

Kahan?

for (k = 1, k <= n, k++)

Use the backside, if needed

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