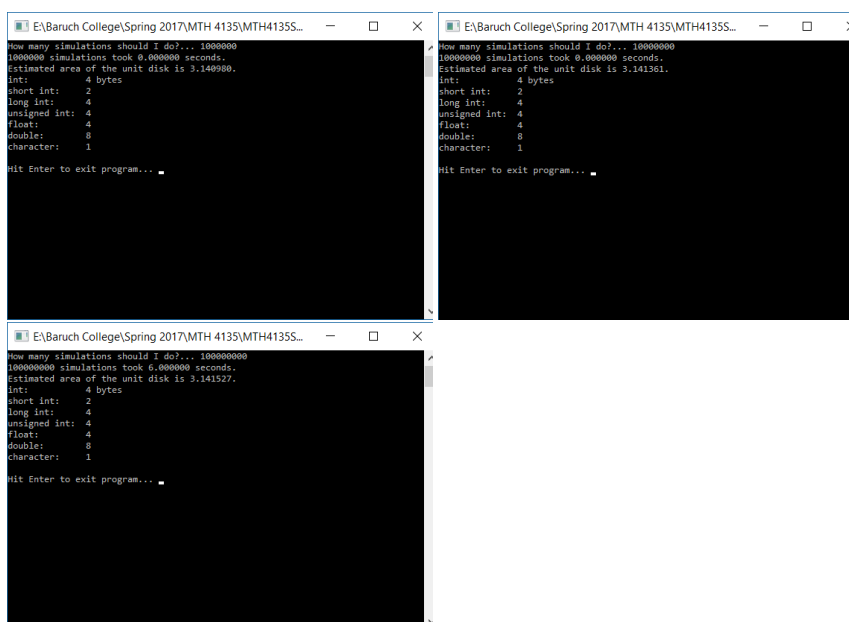


MTH 4135 Homework 1

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1. Download the program **TimedPi.cpp** and the header files **Declarations.h** and **Definitions.h** into the same folder. Compile **TimedPi.cpp** and run it performing 1 million, 10 million, and 100 million simulations. For each of these runs, attach a screen snapshot.



```
E:\Baruch College\Spring 2017\MTH 4135\MTH4135S...
How many simulations should I do?... 10000000
10000000 simulations took 0.000000 seconds.
Estimated area of the unit disk is 3.140980.
int: 4 bytes
short int: 2
long int: 4
unsigned int: 4
float: 4
double: 8
character: 1
Hit Enter to exit program...

E:\Baruch College\Spring 2017\MTH 4135\MTH4135S...
How many simulations should I do?... 100000000
100000000 simulations took 0.000000 seconds.
Estimated area of the unit disk is 3.141361.
int: 4 bytes
short int: 2
long int: 4
unsigned int: 4
float: 4
double: 8
character: 1
Hit Enter to exit program...

E:\Baruch College\Spring 2017\MTH 4135\MTH4135S...
How many simulations should I do?... 1000000000
1000000000 simulations took 0.000000 seconds.
Estimated area of the unit disk is 3.141527.
int: 4 bytes
short int: 2
long int: 4
unsigned int: 4
float: 4
double: 8
character: 1
Hit Enter to exit program...
```

2. The five dimensional unit ball is the subset of \mathbb{R}^5 given by

$$B = \{(v, w, x, y, z) : v^2 + w^2 + x^2 + y^2 + z^2 \leq 1\}$$

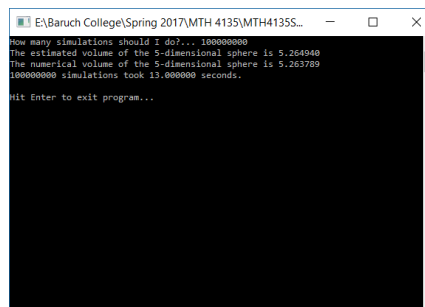
Let C denote the five dimensional cube

$$C = \{(v, w, x, y, z) : |v| \leq 1, |w| \leq 1, |x| \leq 1, |y| \leq 1, |z| \leq 1\}$$

so $B \subset C$. Since each side of C is of length 2, the five-dimensional "volume" of C is $2^5 = 32$. Modify **TimedPi.cpp** to use Monte Carlo simulation to estimate what fraction of C 's volume is also occupied by B . Use this to estimate the five dimensional volume of B . You should do at least 100 million simulations. Google the words "n-ball volume" and go to the Wikipedia page. From their formula, compute the numerical value of the volume of the 5 dimensional unit ball.

Executive Summary:

Methodology:



```
E:\Baruch College\Spring 2017\MTH 4135\MTH4135S_
How many simulations should I do?...100000000
The estimated volume of the 5-dimensional sphere is 5.264948
The numerical volume of the 5-dimensional sphere is 5.263789
100000000 simulations took 13.000000 seconds.
Hit Enter to exit program...
```