Fun with MinGW

(или "А ты верифицировал свою стандартную функцию?!)

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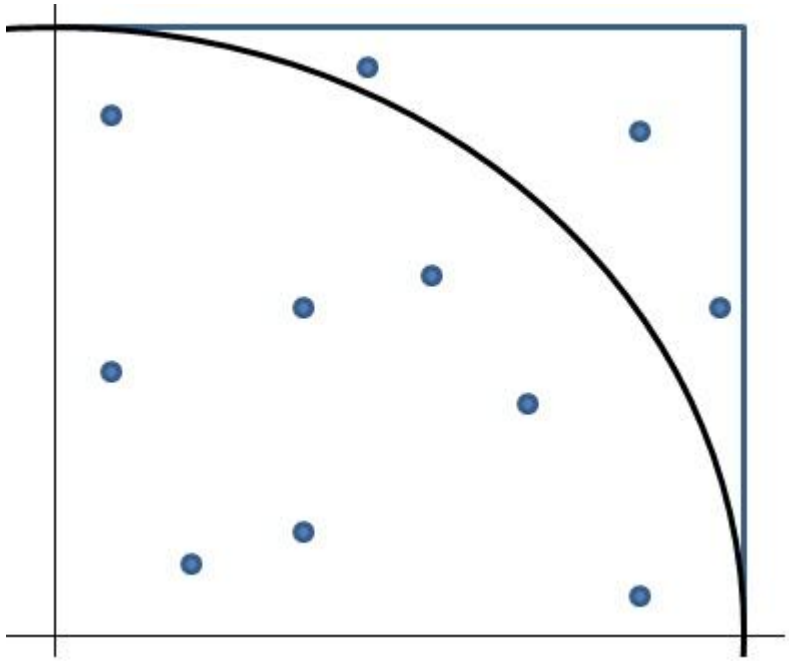
Part I

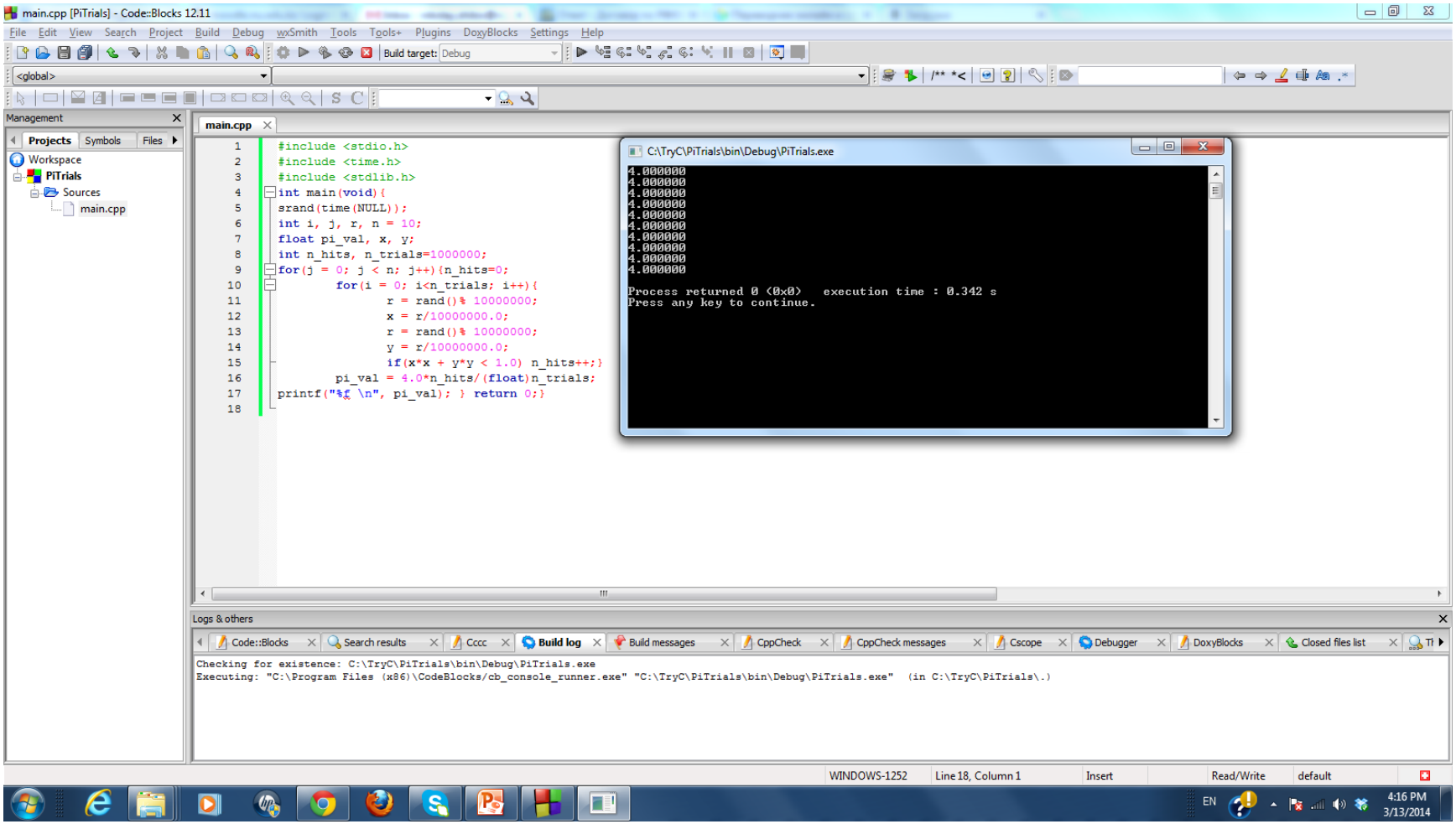
EXPERIMENT WITH MINGW

MonteCarlo.c

```
#include <stdio.h>
#include <time.h>
#include <stdlib.h>
int main(void){
srand(time(NULL));
int i, j, r, n = 10;
float pi_val, x, y;
int n_hits, n_trials=1000000;
for(j = 0; j < n; j++){n_hits=0;
      for(i = 0; i<n_trials; i++){
            r = rand()% 10000000;
            x = r/10000000.0;
            r = rand()% 10000000;
            y = r/10000000.0;
            if(x*x + y*y < 1.0) n_hits++;}
      pi_val = 4.0*n_hits/(float)n_trials;
printf("%f \n", pi_val); } return 0;}
```



Experiment


main.cpp [PiTrials] - Code::Blocks 12:11
File Edit View Search Project Build Debug wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help
Build target: Debug
Management
Projects Symbols Files
Workspace
PiTrials
Sources
main.cpp
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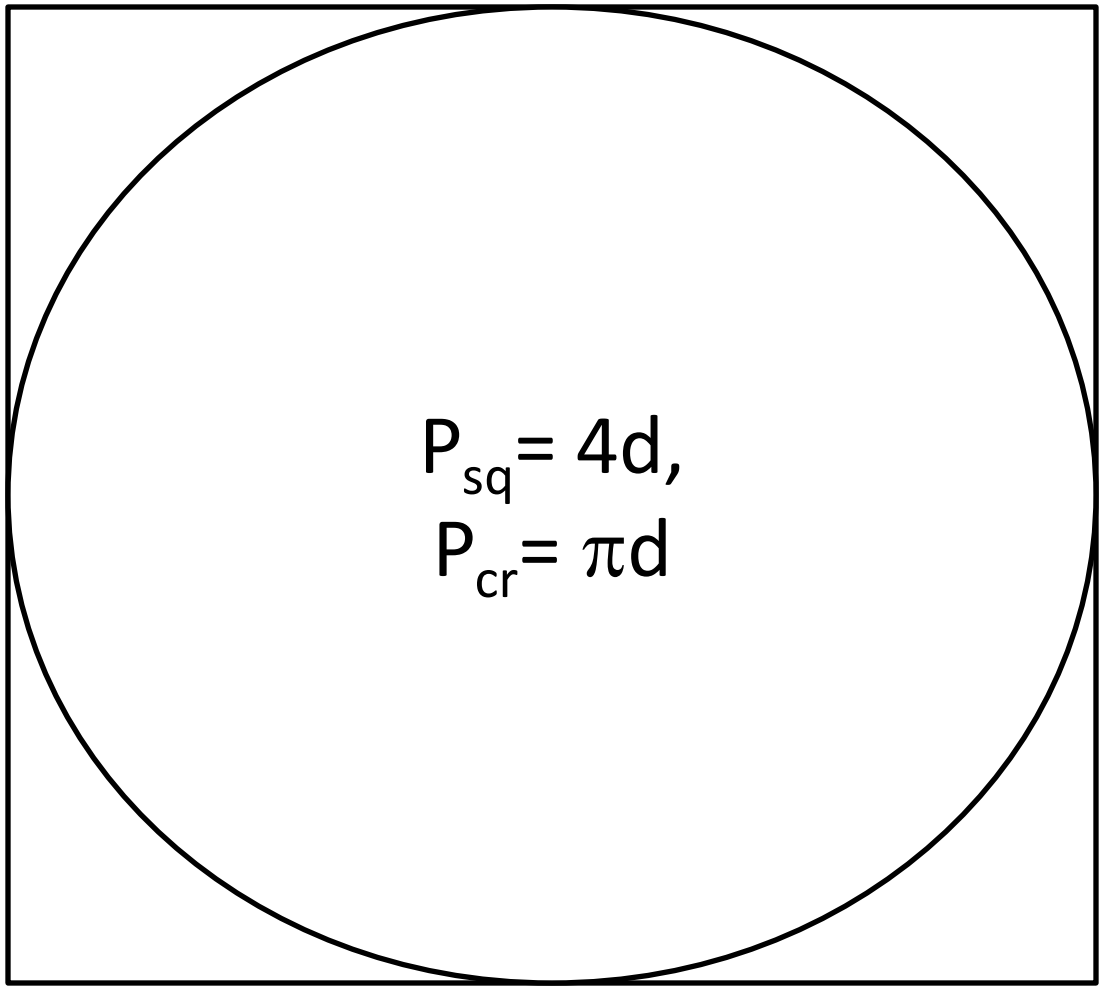
pi_val = 4.0*n_hits/(float)n_trials;
printf("%f \n", pi_val); } return 0;}
C:\TryC\PiTrials\bin\Debug\PiTrials.exe
4.000000
4.000000
4.000000
4.000000
4.000000
4.000000
4.000000
4.000000
4.000000
4.000000
Process returned 0 (0x0) execution time : 0.342 s
Press any key to continue.
Logs & others
Code::Blocks Search results Cccc Build log Build messages CppCheck CppCheck messages Cscope Debugger DoxyBlocks Closed files list
Checking for existence: C:\TryC\PiTrials\bin\Debug\PiTrials.exe
Executing: "C:\Program Files (x86)\CodeBlocks/cb_console_runner.exe" "C:\TryC\PiTrials\bin\Debug\PiTrials.exe" (in C:\TryC\PiTrials\.)
WINDOWS-1252 Line 18, Column 1 Insert Read/Write default
EN
4:16 PM
3/13/2014

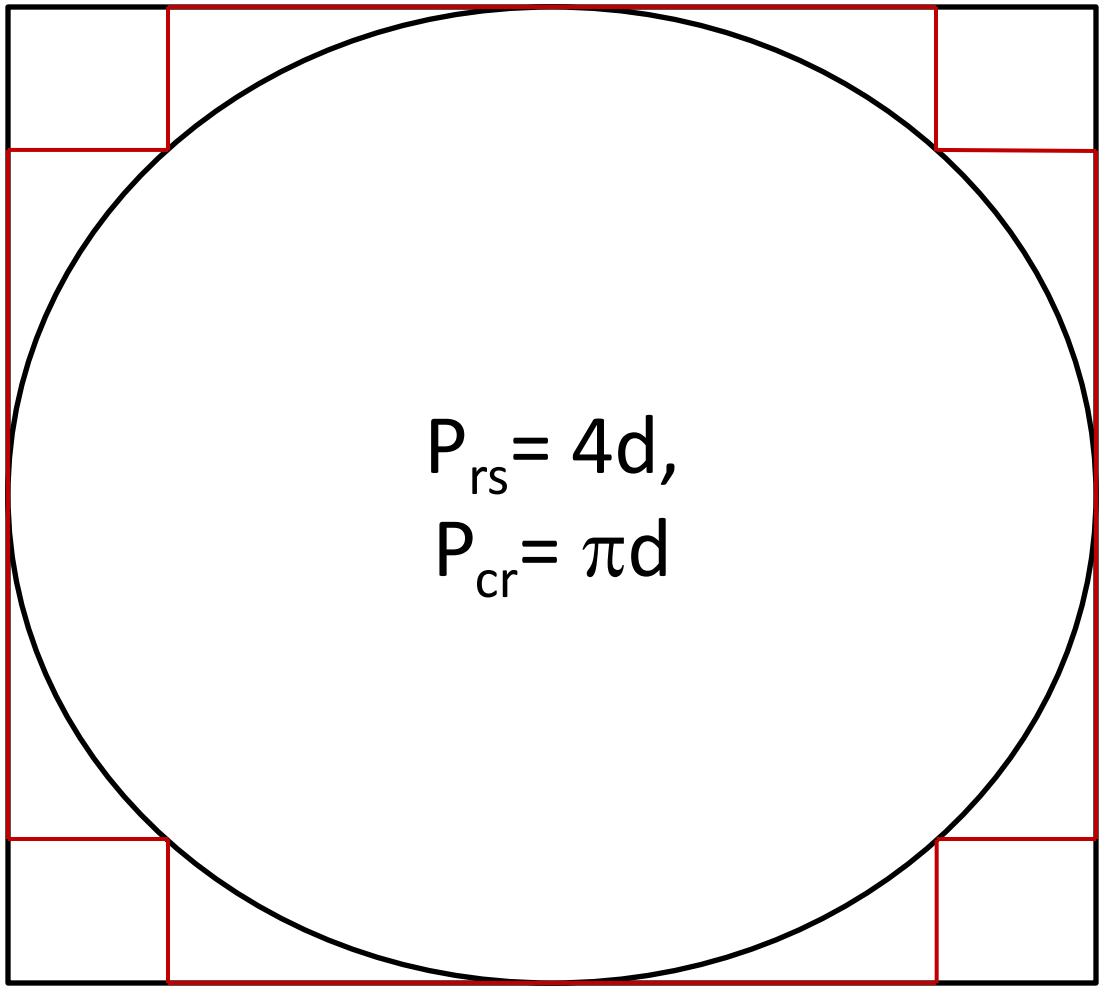
Part II

CAN MANUAL POOF HELP?

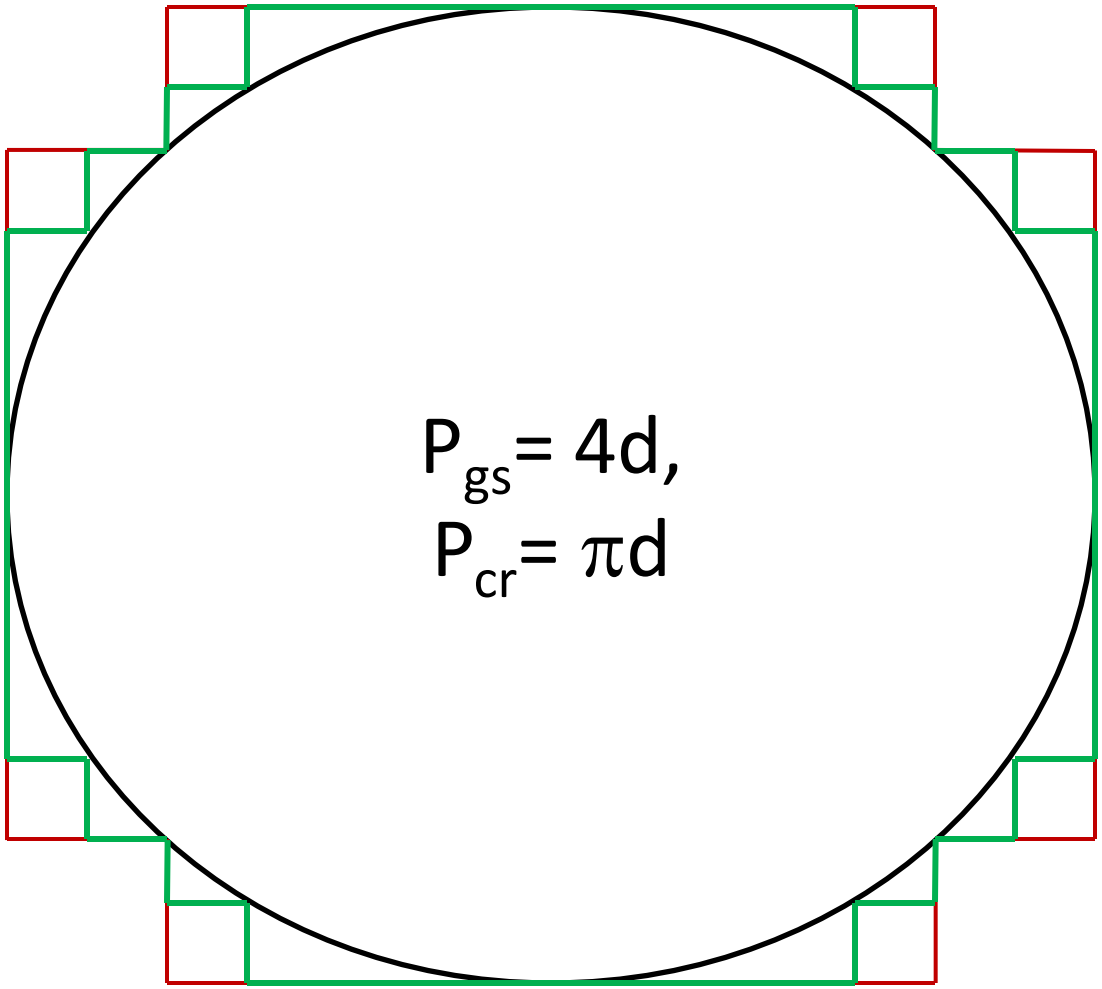
Proof



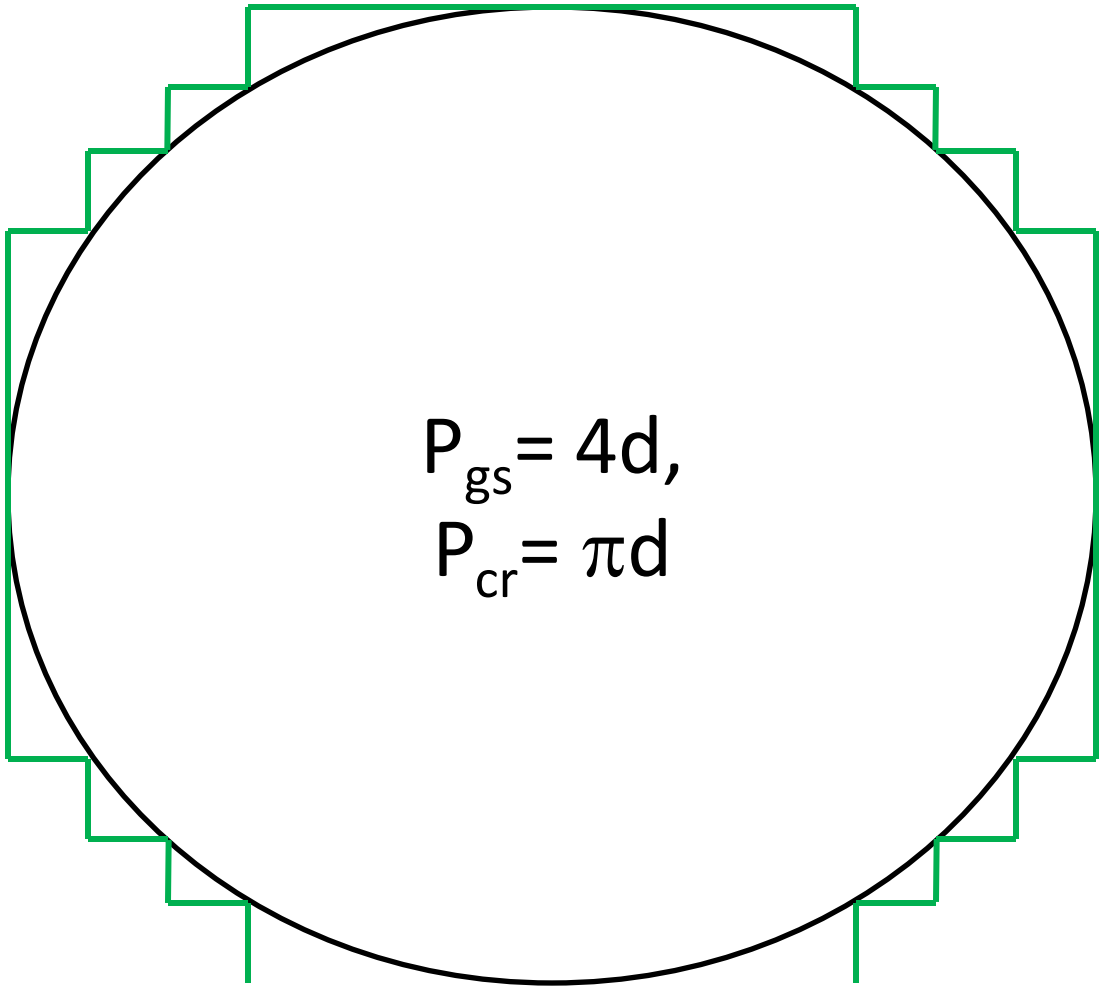
Proof (cont.)



Proof (cont.)



Proof (cont.)



$P_{gs} = 4d,$

$P_{cr} = \pi d$

Proof (cont.)

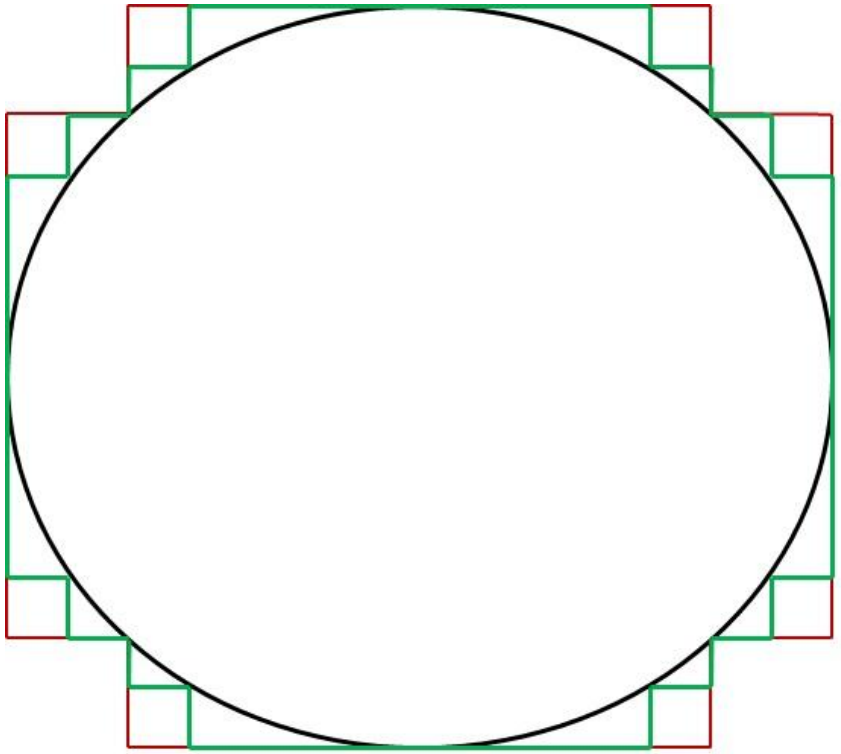
- The figure around the circle converges to the circle; hence its perimeter converges to πd.
- but the value of the perimeter is constant 4d;
- hence π=4.

Part III

VERSES ABOUT π

If you aren't convinced, then Poetry should help…

π is 4, – I don't joke!
4 is π, – I don't lie…
Draw a square near circle
(with diameter 1),
Cut its corners,
then new corners,
Proceed further
one by one.
4 is length of figure's border,
Length of circle equals π;
Border line converges to circle,
It implies that 4 is π!



Part IV

WHAT IS WRONG?

Formal Methods as a Rescue

- Let us specify the program in Hoare style by pre- and post-conditions.
- The pre-condition may be TRUE since the program has no input.
- The post-condition should be pi_val==4.0 due to exercises of the program.
- So we may hope to prove the following total correctness assertion

$$\vdash [\mathrm{TRUE}]\ \mathrm{PiMC}\ [\mathrm{pi\_val}=4.0].$$

Formal Methods as a Rescue

- But if we try to apply *axiomatic semantics* to generate verification conditions and prove the assertion then we encounter a problem of axiomatic semantics of the assignment

```
r = rand()% 10000000;
```

that has 2 instances in the program.

Part V

WHAT IS WRONG …
WITH FORMAL METHODS?

Really Rethinking *Formal Methods*

- Recently David L. Parnas have called (in the paper “Really Rethinking *Formal Methods*”) to question the well-known current formal software development methods why they have not been widely adopted in industry and what should be changed.

In my humble opinion…

- Industrial applications of Formal Methods are not the unique measure of success.
- Another dimension where we can discuss utility of Formal Methods could be better education.

In my humble opinion…

- A very popular (in Russia) aphorism of Mikhail Lomonosov (the first Russian academician) says: *Mathematics should be learned just because it disciplines and bring up the mind*.
- I do believe that Formal Methods discipline and bring up minds in Computer Science.

In my humble opinion…

- A part of the reason of student's and engineer's poor attitude to Formal Methods, is very simple: FM-experts do not care about primary education in this field at the early stage of higher education.

Why this talk?

- I would like to present some funny example that (I believe) may help to attract attention of NSU community to study of Formal Methods and their use in (free) SW development.

Грамотность vs. Образование

- Программирование – вторая грамотность.

  А.П. Ершов

  http://ershov.iis.nsk.su/russian/second_literacy/article

- Цель образования – образование ума, а не приобретение конкретных навыков.

  К. Вейерштрасс

- Формальные методы – это уже образование.

Thanks!

(Questions?)