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HOW MANY NATURAL NUMBERS ARE THERE ON A CIRCLE?

Abstract: The article deals with the problem of placing natural numbers on a circle without repetitions.

Key words: natural numbers, circle, delphi.

Language: English

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Introduction

Consider the question of placing natural numbers on a circle without repetitions. This problem occurs when using encoding methods. Let's set a known error in advance and changing its order we will determine the number of natural numbers that can be placed on

the circle moving along it. At coincidence of two points on a circle process we will stop and increase accuracy of calculation.

$$\varepsilon = 0.1 \dots 0.00001$$

```
function check(p:integer):boolean;
begin
s:=0;
t:=trunc(p/(2*pi*R)/e)*e;
while t>2*pi do t:=trunc((t-2*pi)/e)*e;

for j := 0 to form1.memol.lines.Count-1 do
begin
if t=strtfloat(form1.Memol.Lines.Strings[j]) then s:=1;
end;

if s=0 then form1.memol.Lines.Add(floattostr(t));
if s=0 then Result:=False else Result:=True;

end;
```

Code 1. The validation algorithm on the database.

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```

procedure TForm1.Button1Click(Sender: TObject);
begin
  memol.clear;  memol.Text:='0';
  e:= strtofloat( Edit1.Text);
  p:=1;
  R:=1;
  while not(check(p)) do
  begin
    p:=p+1;
    label3.Caption:=inttostr(p);
    Application.ProcessMessages;
  end;
end;

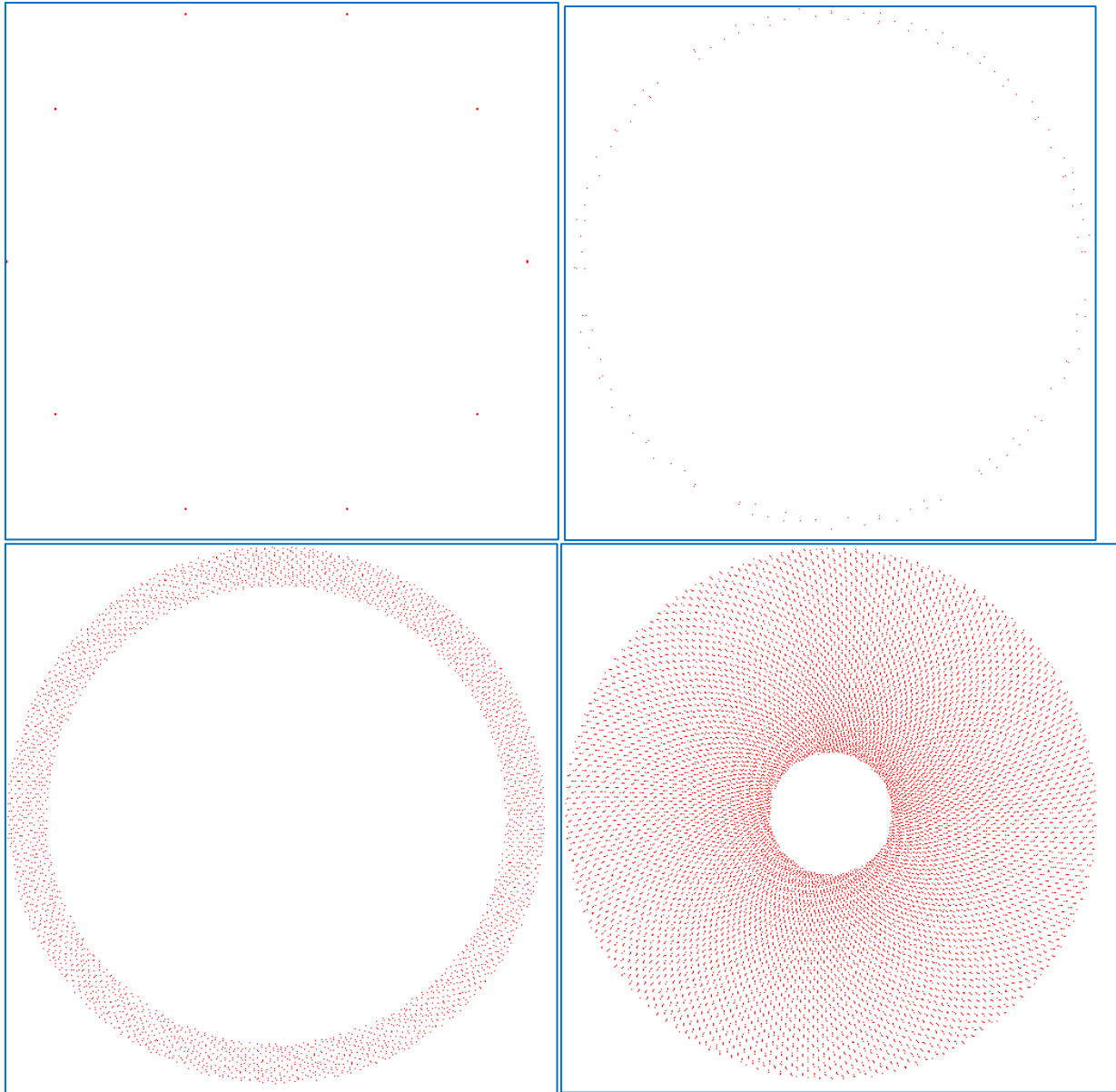
```

Code 2. Setting the settings and output the result

Error ε	0,1	0,01	0,001	0,0001
Count of natural numbers placed on a circle without repetitions	40	128	3 604	21 042
Total number of values	62	628	6 283	62 831
%	64 %	20 %	57 %	33 %
Sequence of numbers	0 0,1 0,3 0,4 0,6 0,7 0,9 1,1 1,2 1,4 1,5 1,7 1,9 2 2,2 2,3 2,5 2,7 2,8 3 3,1 3,3 3,5 3,6 3,8 3,9 4,1 4,2 4,4 4,6 4,7 4,9 5 5,2 5,4	0 0,15 0,31 0,47 0,63 0,79 0,95 1,11 1,27 1,43 1,59 1,75 1,9 2,06 2,22 2,38 2,54 2,7 2,86 3,02 3,18 3,34 3,5 3,66 3,81 3,97 6,04 6,2 0,06 0,22	0 0,159 0,318 0,477 0,636 0,795 0,954 1,114 1,273 1,432 1,591 1,75 1,909 2,069 2,228 2,387 2,546 2,705 2,864 3,023 3,183 3,342 3,501 3,66 3,819 3,978 4,138 4,297 4,456 4,615 4,774 6,124	0 0,1591 0,3183 0,4774 0,6366 0,7957 0,9549 1,114 1,2732 1,4323 1,5915 1,7507 1,9098 3,8958 4,055 4,2141 4,3733 4,5325 4,6916 4,8508 5,0099 5,1691 5,3282 5,4874 5,6465 5,8057 5,9648 6,124

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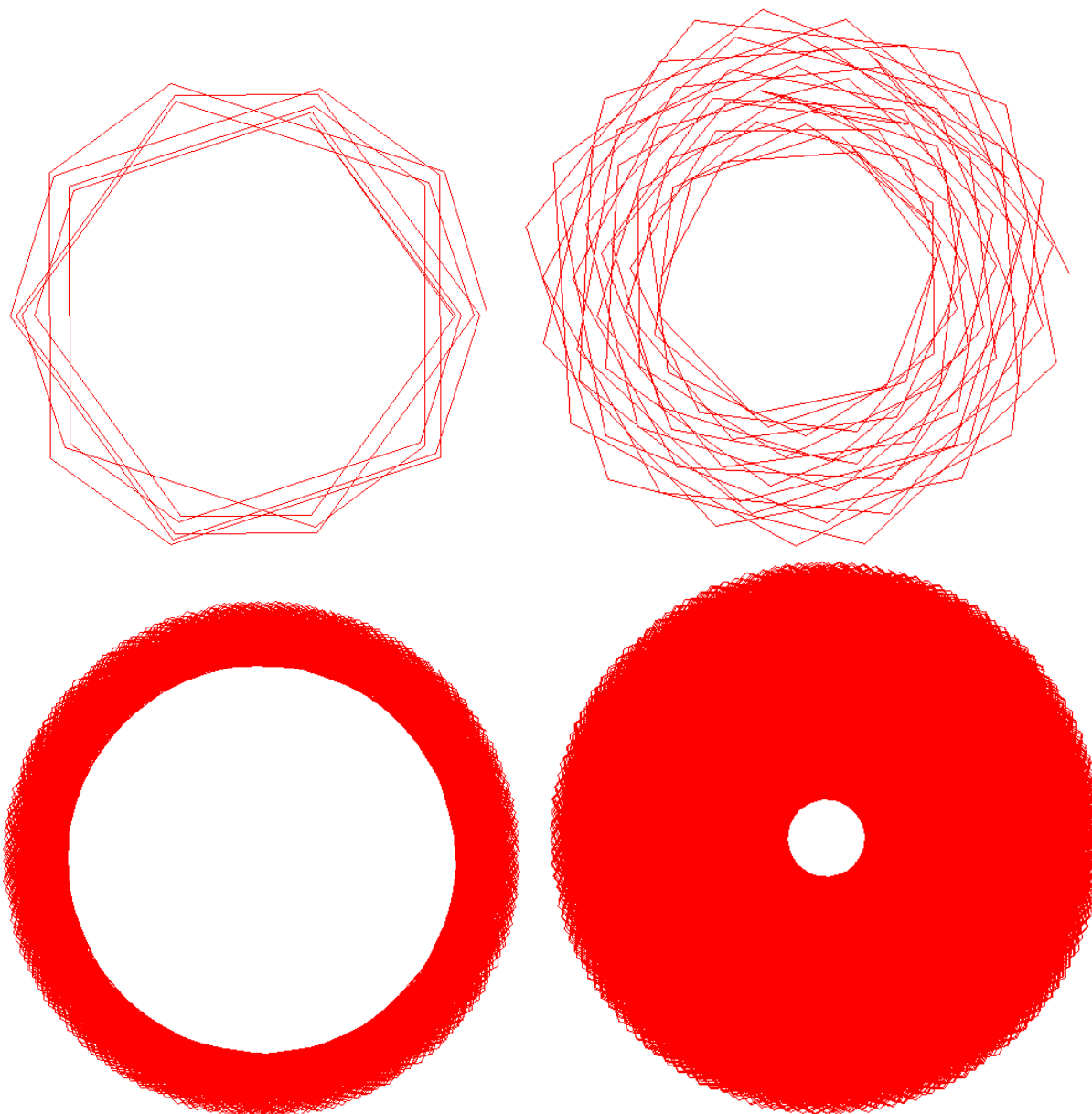
	5,5	0,38	0,318	
	5,7	0,54	0,477	
	5,8	0,7	0,636	
	6	0,86	0,795	
	6,2	1,02	0,954	
		1,18	1,113	
		1,34	1,272	
			1,432	
			1,591	



Pic.1. The point distribution

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Pic.2. The line distribution

Conclusion

As a result of the study, it can be concluded that at least 30 % of the natural numbers can be placed on the circle without repetition, taking into account the error of the numerical calculation of epsilon. Repeated

100 calculations for each epsilon did not reveal strong differences from the values given. The uniform distribution on the corners allows you to use this number in the coding systems.

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