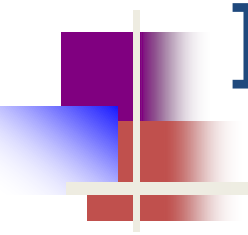


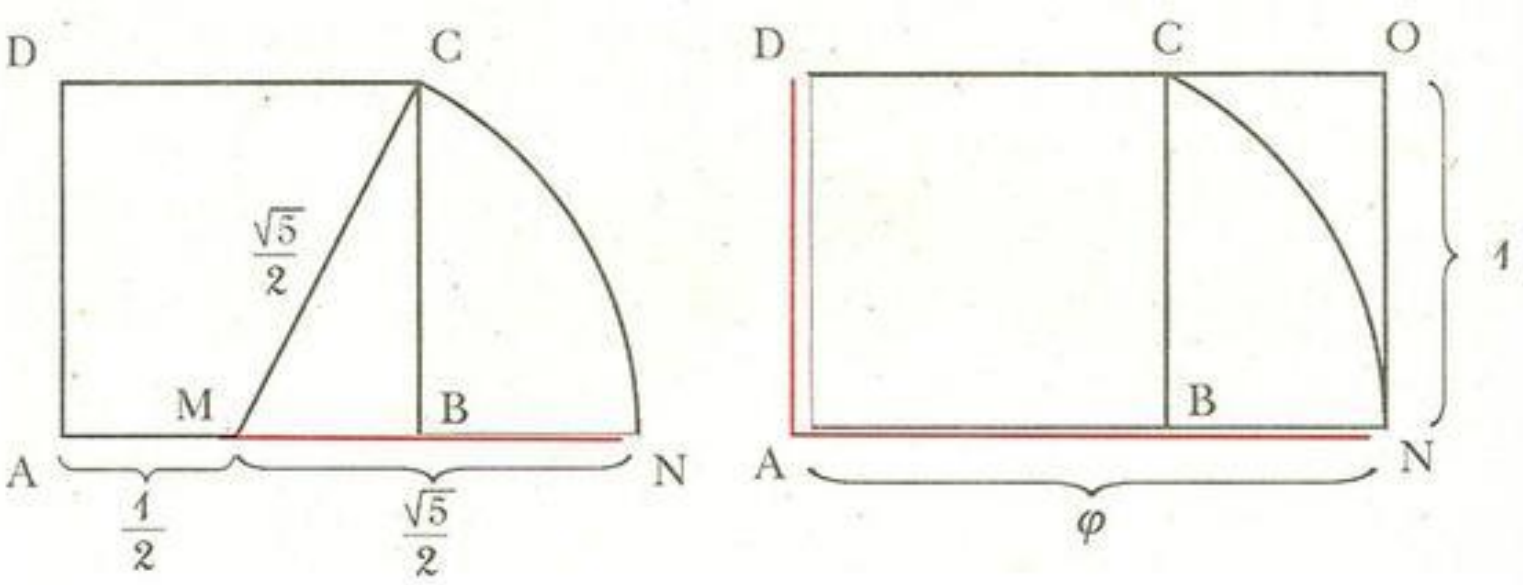
Introducere

Proportia de aur

- In Matlab: phi = (1 + sqrt(5))/2
- Cat este?
- 1.6180 sau
- 1.618033988749895

$$\varphi = \frac{1+\sqrt{5}}{2}$$

Dreptunghiul de aur



Dreptunghi care are raportul laturilor egal cu numarul de aur

$$\frac{1}{\varphi} = \frac{\varphi - 1}{1}$$

$$\frac{1}{\varphi} = \frac{\varphi - 1}{1}$$

$\phi(\phi - 1) = 1$

$$\varphi^2 - \varphi - 1 = 0 \Rightarrow \varphi_{1,2} = \frac{1 \pm \sqrt{5}}{2}$$

Rezolvare ecuatiei cu Matlab

- solutia 1:
  - Ecuatia ca polinom:precizam coef in ordinea descrescatoare a gradelor
  - Aflam radacinile cu functia roots

- p=[1 -1 -1]
- r=roots(p)
- phi=r(2)

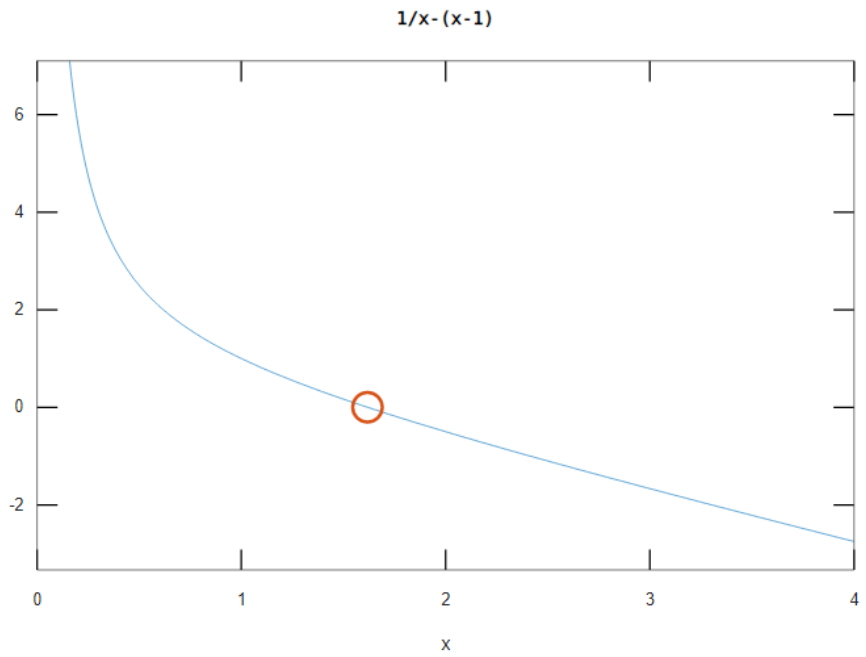
Rezolvare ecuatiei cu Matlab

- Solutia 2:
  - Definim o functie f
  - Aflam solutiei f=0 cu functia fzero

```
octave:20> f=@(x) 1./x-(x-1)
f =
@(x) 1 ./ x - (x - 1)
octave:21> fzero(f,1.1)
ans = 1.61803398874894
```

Putem si reprezenta grafic functia f pe intervalul [0,4] si punctul phi.

```
octave:37> plot(phi,0,'o')
```



- f=@(x) 1./x-(x-1);
- ezplot(f,[0,4])
- phi = fzero(f,1.1)
- hold on
- plot(phi,0,'o')

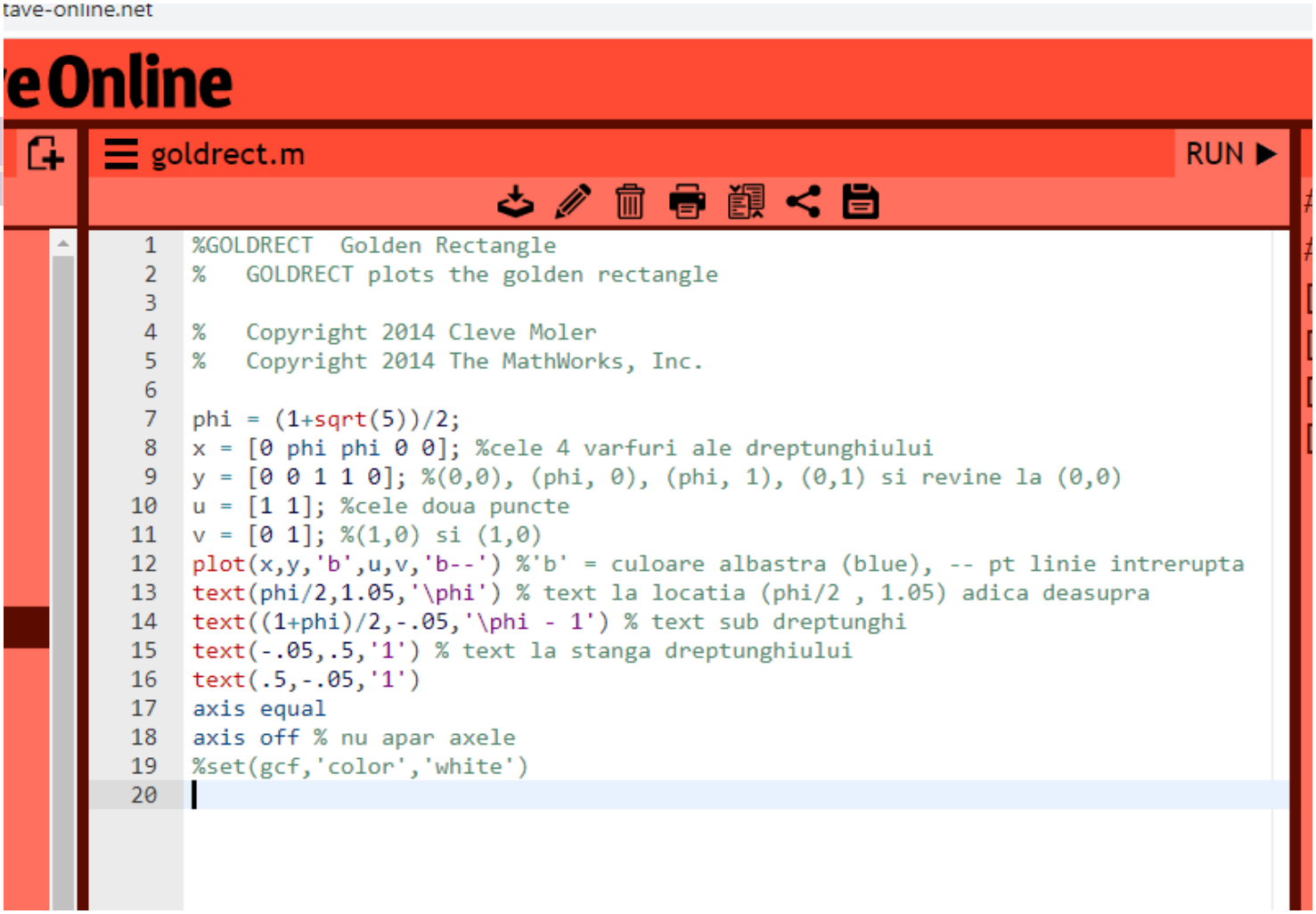
- Scriptul goldrect.m deseneaza dreptunghiul de aur.

```
%GOLDRECT  Golden Rectangle
%   GOLDRECT plots the golden rectangle

%   Copyright 2014 Cleve Moler
%   Copyright 2014 The MathWorks, Inc.
```

```
phi = (1+sqrt(5))/2;
x = [0 phi phi 0 0];
y = [0 0 1 1 0];
u = [1 1];
v = [0 1];
```

```
plot(x,y,'b',u,v,'b--')
text(phi/2,1.05,'\phi')
text((1+phi)/2,-.05,'\phi - 1')
text(-.05,.5,'1')
text(.5,-.05,'1')
axis equal
axis off
set(gcf,'color','white')
```


tave-online.net
eOnline
goldrect.m
RUN
%GOLDRECT Golden Rectangle
%   GOLDRECT plots the golden rectangle
%   Copyright 2014 Cleve Moler
%   Copyright 2014 The MathWorks, Inc.
phi = (1+sqrt(5))/2;
x = [0 phi phi 0 0]; %cele 4 varfuri ale dreptunghiului
y = [0 0 1 1 0]; %(0,0), (phi, 0), (phi, 1), (0,1) si revine la (0,0)
u = [1 1]; %cele doua puncte
v = [0 1]; %(1,0) si (1,0)
plot(x,y,'b',u,v,'b--') %'b' = culoare albastra (blue), -- pt linie intrerupta
text(phi/2,1.05,'\phi') % text la locatia (phi/2 , 1.05) adica deasupra
text((1+phi)/2,-.05,'\phi - 1') % text sub dreptunghi
text(-.05,.5,'1') % text la stanga dreptunghiului
text(.5,-.05,'1')
axis equal
axis off % nu apar axele
%set(gcf,'color','white')

Proportia de aur

- Proportia de aur este proportia unei fețe umane perfecte.
- Leonardo da Vinci a fost primul care a analizat proporțiile corpului uman. El a demonstrat că, fiecare componentă a corpului uman respectă proporția numărului de aur.
- Majoritatea pictorilor au respectat proporția de aur în tablourile lor.

http://vasileteodor.ro/articol/numerele-lui-fibonacci-si-proportia-de-aur

Sirul lui Fibonacci

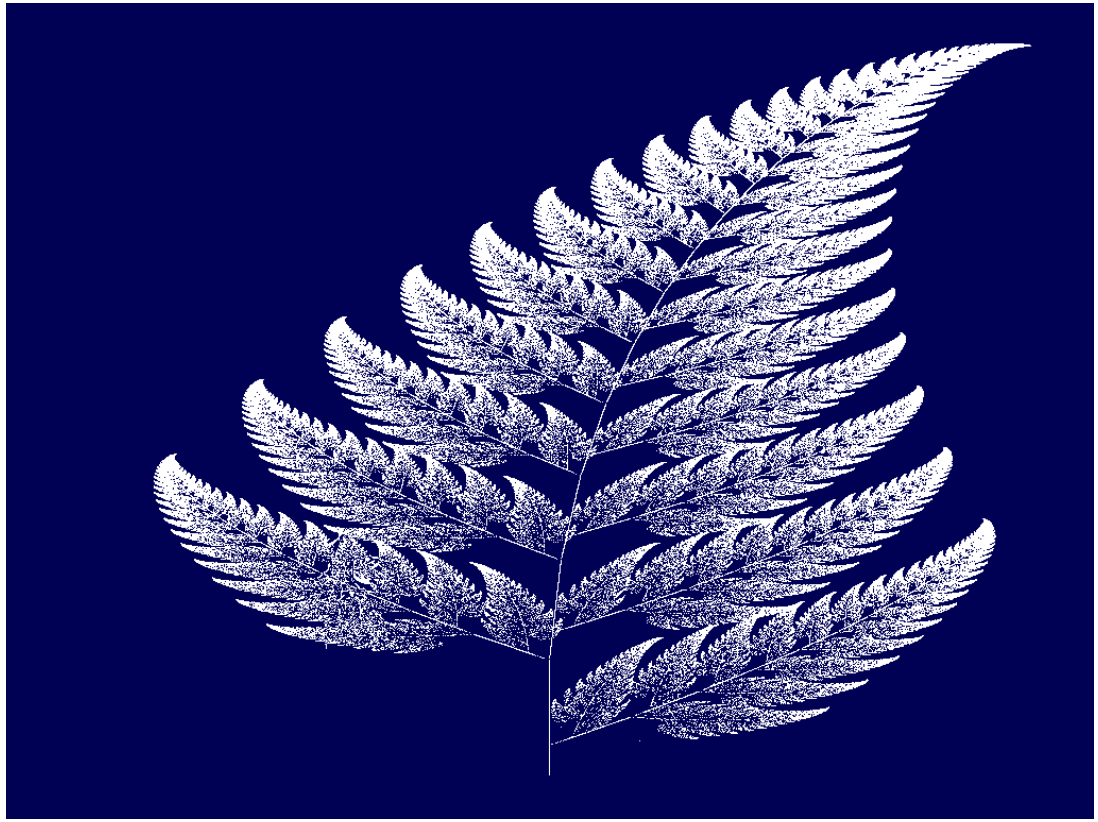
- 1,1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610,…

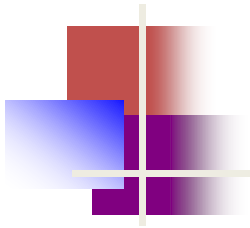
```
function f = fibonacci(n)
% FIBONACCI Fibonacci sequence
% f = FIBONACCI(n) generates the first n
Fibonacci numbers.
f = zeros(n,1);
f(1) = 1;
f(2) = 2;
for k = 3:n
     f(k) = f(k-1) + f (k-2);
end
```

Relatia dintre sirul lui Fibonacci si proportia de aur

A	B	B / A
2	3	1.5
3	5	1.666666666...
5	8	1.6
8	13	1.625
13	21	1.615384615...
...	...	...
144	233	1.618055556...
233	377	1.618025751...
...	...	...

- Scriptul fern.m





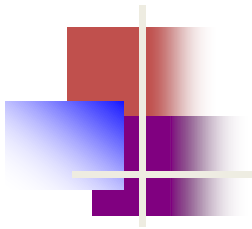
- fern.m
- finitefern.m

- https://www.mathworks.com/moler/index_ncm.html
- Numerical Computing with MATLAB – free textbook

```
function F = finitefern(varargin)
%FINITEFERN   MATLAB implementation of the Fractal Fern.
%   Michael Barnsley, "Fractals Everywhere", Academic Press, 1993.
%
%   FINITEFERN with no arguments plots 100000 points.
%   FINITEFERN(N) plots N points.
%   FINITEFERN(N,'s') shows each step.
%
%   F = FINITEFERN(N,r,c) returns an r-by-c sparse logical
%   bit map array that can be viewed with
%      spy(F)
%   or
%      image(F)
%      colormap([1 1 1; 0 2/3 0])
%   F can be saved in PNG (Portable Network Graphics) format with
%      imwrite(full(F),'myfern.png','png','bitdepth',1)
%
%   See also: FERN.

%   Copyright 2014 Cleve Moler
%   Copyright 2014 The MathWorks, Inc.

showstep = (nargin >= 1) && ischar(varargin{end});
if showstep || (nargout == 0)
   clf
   shg
   set(gcf,'menubar','none','numbertitle','off','name','Finite Fern', ...
       'color','black')
   darkgreen = [0 2/3 0];
   darkred = [2/3 0 0];
end
if showstep
   finish = uicontrol('style','toggle','string','finish', ...
      'value',0,'background','white');
end
if (nargin >= 1) && ~ischar(varargin{1})
   n = varargin{1};
else
   n = 100000;
end
```



```
p  = [ .85  .92  .99  1.00];
A1 = [ .85  .04; -.04  .85];  b1 = [0; 1.6];
A2 = [ .20 -.26;  .23  .22];  b2 = [0; 1.6];
A3 = [-.15  .28;  .26  .24];  b3 = [0; .44];
A4 = [  0    0 ;   0   .16];

x = [.5; .5];
xs = zeros(2,n);
xs(:,1) = x;
for j = 2:n
   r = rand;
   if r < p(1)
      x = A1*x + b1;
   elseif r < p(2)
      x = A2*x + b2;
   elseif r < p(3)
      x = A3*x + b3;
   else
      x = A4*x;
   end
   xs(:,j) = x;
   if showstep
      h = plot(xs(1,1:n-1),xs(2,1:n-1),'.',x(1),x(2),'o');
      set(h(1),'markersize',6,'color',darkgreen);
      set(h(2),'color',darkred);
      axis([-3 3 0 10])
      axis off
      showstep = get(finish,'value') == 0;
      if ~showstep, delete(finish), end
      pause(.01)
   end
end

if nargout == 0
   plot(xs(1,:),xs(2,:),'.','markersize',1,'color',darkgreen);
   axis([-3 3 0 10])
   axis off
else
   if nargin < 3
      r = 768; c = 1024;
   else
      r = varargin{2}; c = varargin{3};
   end
   j = round((xs(1,:)+3)/6*c);
   i = round((9-.9*xs(2,:)+.5)/10*r);
   F = sparse(i,j,1,r,c)~=0;
end
```