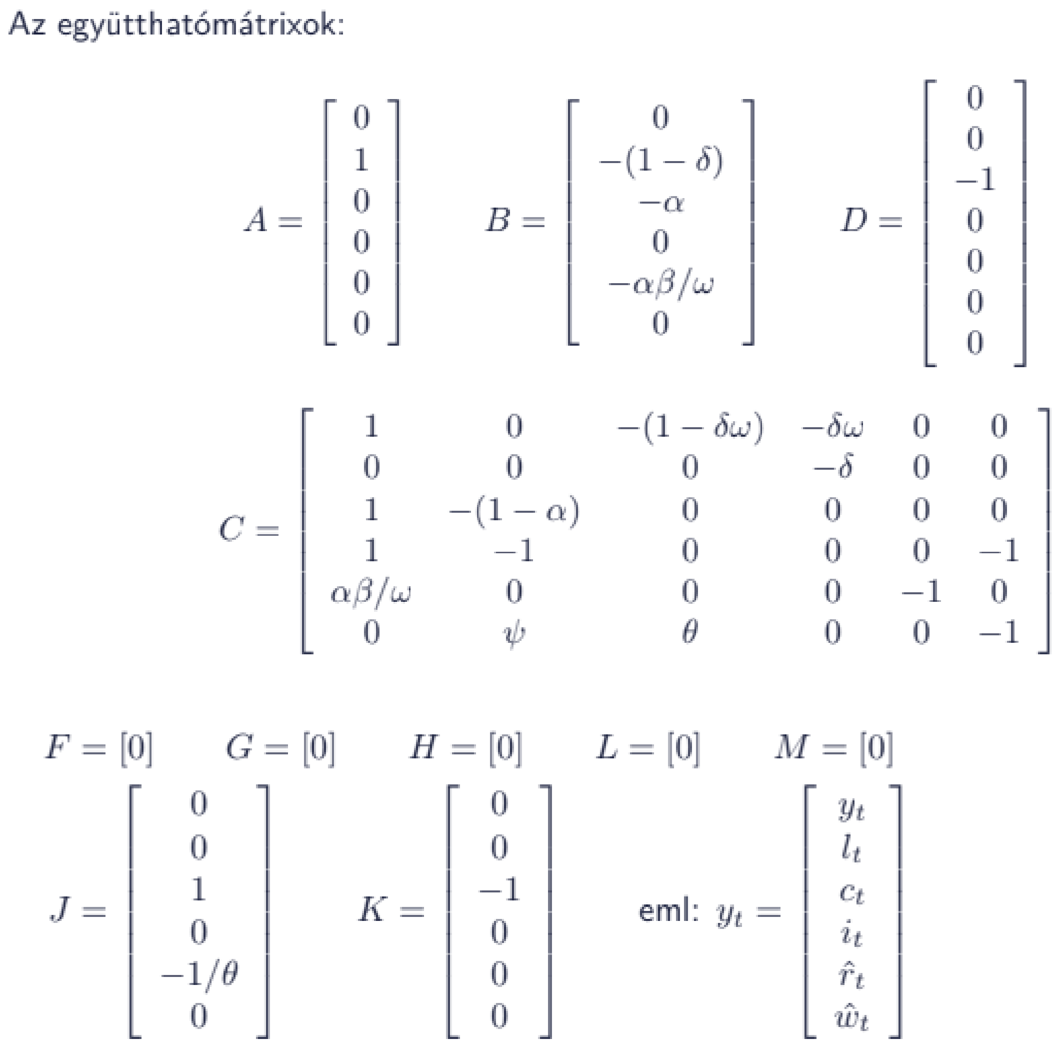
Loglinearizalt RBC modell - impulzus-valasz fuggvenyek Uhlig algoritmussal

Definialjuk a parametereket

In [1]:

```
# Eloadason kalibralt parameterek
alpha = 0.44
beta = 0.964
delta = 0.054
# Preferencia parameterek a szakirodalomnak megfeleloen
theta = 1.5
psi = 0
rho = 0.85
sigma = 0.05

omega = alpha*beta/(1-beta*(1-delta));
```

Definialjuk a szukseges egyutthato matrixokat



Az együtthatómátrixok:

$$A = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \qquad B = \begin{bmatrix} 0 \\ -(1-\delta) \\ -\alpha \\ 0 \\ -\alpha\beta/\omega \\ 0 \end{bmatrix} \qquad D = \begin{bmatrix} 0 \\ 0 \\ -1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 0 & -(1-\delta\omega) & -\delta\omega & 0 & 0 \\ 0 & 0 & 0 & -\delta & 0 & 0 \\ 1 & -(1-\alpha) & 0 & 0 & 0 & 0 \\ 1 & -1 & 0 & 0 & 0 & -1 \\ \alpha\beta/\omega & 0 & 0 & 0 & -1 & 0 \\ 0 & \psi & \theta & 0 & 0 & -1 \end{bmatrix}$$

$$F = [0] \qquad G = [0] \qquad H = [0] \qquad L = [0] \qquad M = [0]$$

$$J = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ -1/\theta \\ 0 \end{bmatrix} \qquad K = \begin{bmatrix} 0 \\ 0 \\ -1 \\ 0 \\ 0 \\ 0 \end{bmatrix} \qquad \text{eml: } y_t = \begin{bmatrix} y_t \\ l_t \\ c_t \\ i_t \\ \hat{r}_t \\ \hat{w}_t \end{bmatrix}$$

In [2]:

```
import numpy as np

A = np.matrix([0, 1, 0, 0, 0, 0]).T
B = np.matrix([0, -(1-delta), -alpha, 0, -alpha*beta/omega, 0]).T
C = np.matrix([[1, 0, -(1-delta*omega), -delta*omega, 0, 0],
          [0, 0, 0, -delta, 0, 0],
          [1, -(1-alpha), 0, 0, 0, 0],
          [1, -1, 0, 0, 0, -1],
          [alpha*beta/omega, 0, 0, 0, -1, 0],
          [0, psi, theta, 0, 0, -1]])
D = np.matrix([0, 0, -1, 0, 0, 0]).T
F = np.matrix([0])
G = np.matrix([0])
H = np.matrix([0])
J = np.matrix([0, 0, 1, 0, -1/theta, 0])
K = np.matrix([0, 0, -1,   0,   0,   0])
L = np.matrix([0])
M = np.matrix([0])
N = np.matrix([rho])
```

Szamitsuk ki a megfelelo egyutthatomatrixokat

$$\Psi = F - JC^{-1}A$$

$$\Gamma = JC^{-1}B + KC^{-1}A - G$$

$$\Theta = KC^{-1}B - H \qquad \Rightarrow$$

$$\Xi = \begin{bmatrix} \Gamma & \Theta \\ I_m & 0_m \end{bmatrix}$$

$$\Delta = \begin{bmatrix} \Psi & 0_m \\ 0_m & I_m \end{bmatrix}$$

In [3]:

```
# Matrixok merete
m, ee = F.shape
n, de = C.shape
k, xe = N.shape

# Matrixok definialasa
Cinv = C.I
PSI = F - J*Cinv*A;
GAMMA = J*Cinv*B + K*Cinv*A - G;
THETA = K*Cinv*B - H;
XI = np.matrix(np.concatenate((
    np.concatenate((GAMMA, THETA), axis = 1),
    np.concatenate((np.identity(m), np.zeros((m,m))), axis=1)), axis=0))
DELTA= np.matrix(np.concatenate((
    np.concatenate((PSI, np.zeros((m,m))), axis = 1),
    np.concatenate((np.zeros((m,m)), np.identity(m)), axis=1)), axis=0))
```

Generalizalt sajatertek problema megoldasa

In [4]:

```
from scipy.linalg import eig
eigvals, eigvecs = eig(XI, DELTA)
```

In [5]:

```
# Ellenorizzuk
```

In [6]:

```
XI*eigvecs
```

Out[6]:

```
matrix([[ 1.7627244 , -1.21587394],
        [-0.75562017,  0.66864544]])
```

In [7]:

```
DELTA*eigvecs*np.diag(eigvals)
```

Out[7]:

```
matrix([[ 1.7627244 +0.j, -1.21587394+0.j],
        [-0.75562017+0.j,  0.66864544+0.j]])
```

In [8]:

```
eigvals
```

Out[8]:

```
array([1.15360091+0.j, 0.89922294+0.j])
```

In [9]:

```
eigvecs
```

Out[9]:

```
array([[-0.75562017,  0.66864544],
       [-0.65501004,  0.74358139]])
```

In [10]:

```
# 0.8992 lesz a stabil sajatertek
LAMBDA = np.matrix([abs(eigvals[1])])
OMEGA = np.matrix([abs(eigvecs[1,1])])
```

Parameterek kiszamitasa:

$$\begin{aligned}
0 &= AP + B + CR \\
0 &= (FP + G + JR)P + H + KR \\
0 &= AQ + CS + D \\
0 &= (FP + G + JR)Q + (FQ + JS + L)N + KS + M
\end{aligned}$$

In [11]:

```
P = OMEGA*LAMBDA/OMEGA
R = -Cinv*(A*P+B)

V = np.concatenate((
    np.concatenate((np.kron(np.identity(k),A),
                    np.kron(np.identity(k),C)), axis=1),
    np.concatenate((np.kron(N.T,F)+np.kron(np.identity(k),(F*P+J*R+G)),
                    np.kron(N.T,J)+np.kron(np.identity(k),K)), axis=1)), axis=0)
LN_plus_M = L*N + M;
QS_vec = (-V).I*np.concatenate((D, LN_plus_M), axis=0)
Q = QS_vec[0]
S = QS_vec[1:]
```

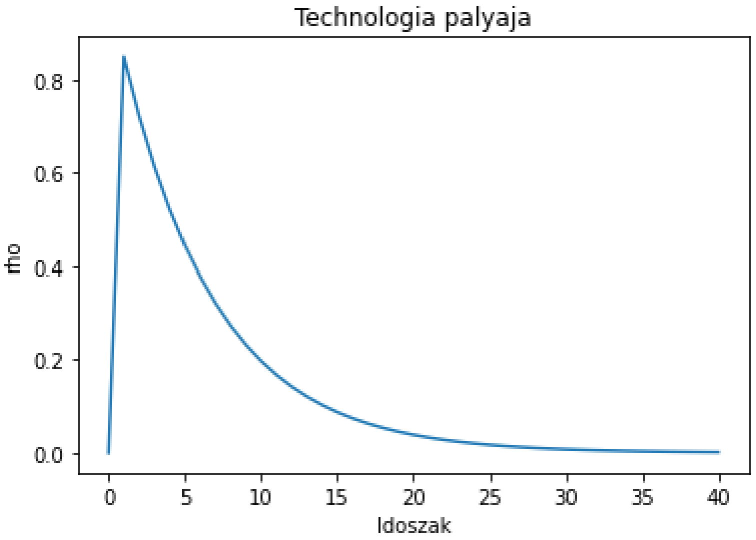
Impulzus-valasz fuggvenyek

In [12]:

```
import matplotlib.pyplot as plt

# A technologia egy szorasnyi sokkot kap
nper = 40;
z = [0, rho]
for i in range(nper-1):
    z.append(rho*z[-1])

fig = plt.figure()
axs = plt.axes()
axs.plot(range(len(z)),z)
axs.set_title('Technologia palyaja')
axs.set_xlabel('Idoszak')
axs.set_ylabel('rho')
```

Out[12]:

```
Text(0, 0.5, 'rho')
```

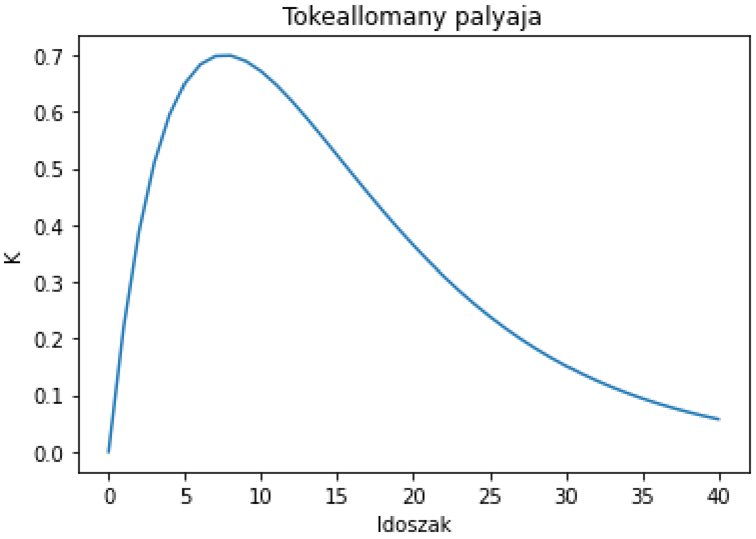


In [16]:

```
# Az allapotvaltozo (k) palyaja
K = [0]
for t in range(nper):
    K.append(P*K[t] + Q*z[t+1])

fig = plt.figure()
axs = plt.axes()
axs.plot(range(len(K)),K)
axs.set_title('Tokeallomany palyaja')
axs.set_xlabel('Idoszak')
axs.set_ylabel('K')
```

Out[16]:

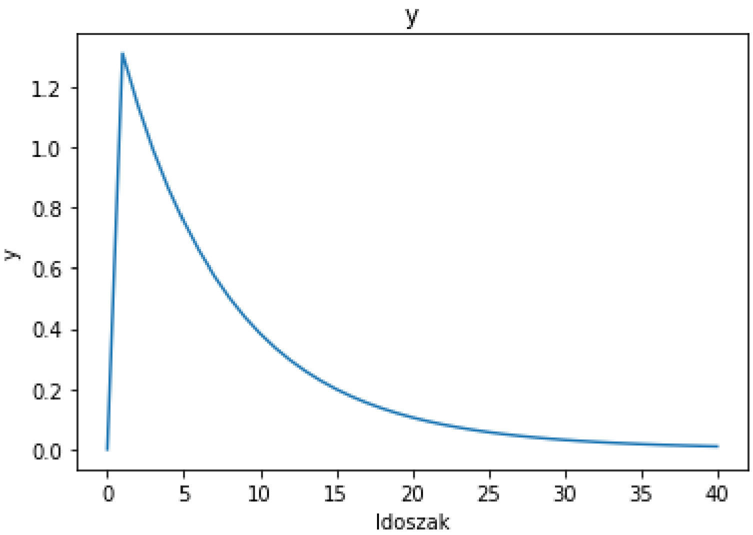
```
Text(0, 0.5, 'K')
```

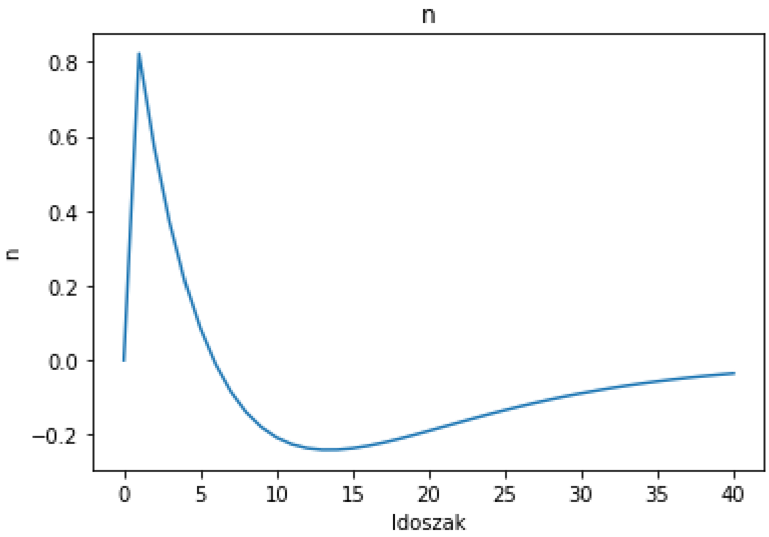


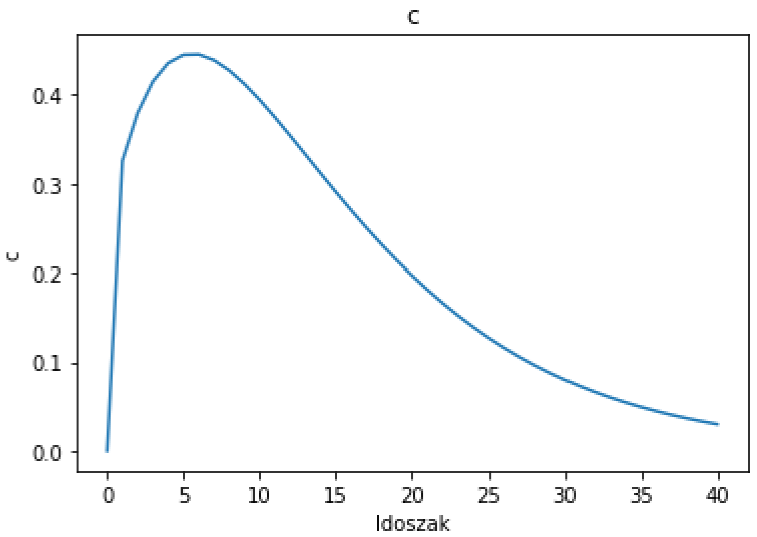
In [14]:

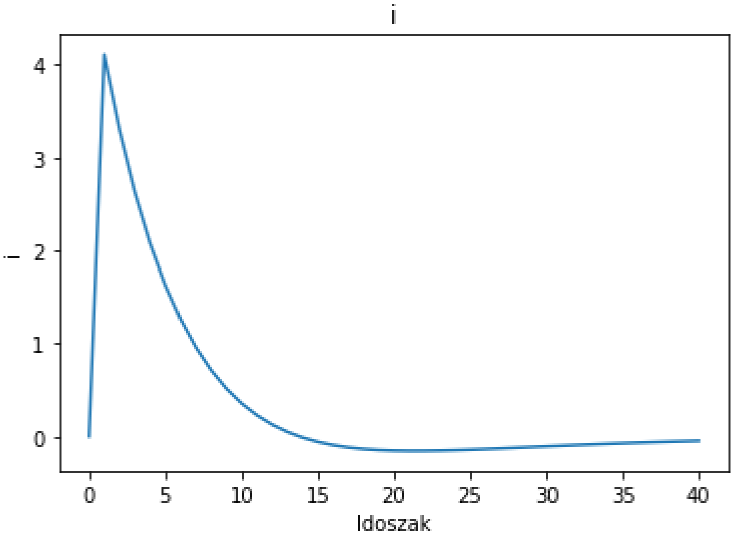
```
# A tobbi endogen valtozo palyaja
y = np.zeros((nper+1, n))
y[1,:] = R.T*K[0] + S.T*z[1]
for t in range(nper-1):
    y[t+2,:] = R.T*K[t+1][0,0] + S.T*z[t+2]

legend_y = ['y', 'n', 'c', 'i', 'r', 'w']
```

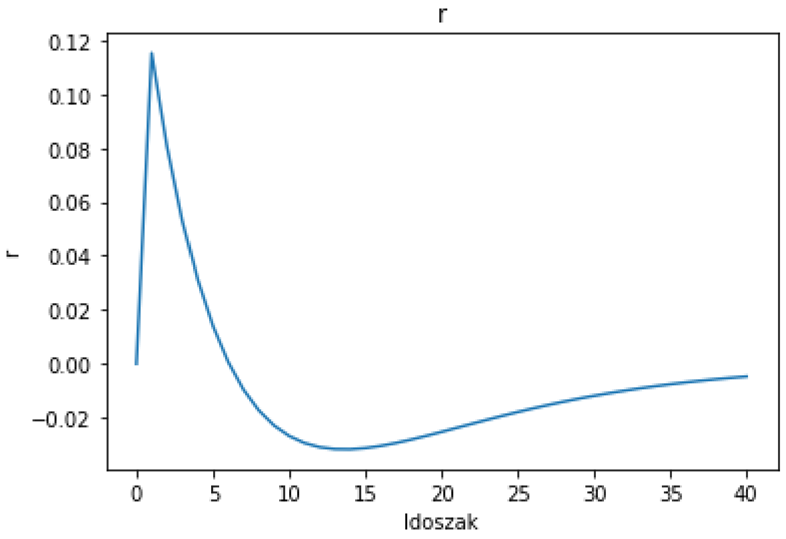
```
for i in range(n):
    fig = plt.figure()
    axs = plt.axes()
    axs.plot(range(len(y[:,i])),y[:,i])
    axs.set_title(legend_y[i])
    axs.set_xlabel('Idoszak')
    axs.set_ylabel(legend_y[i])
```

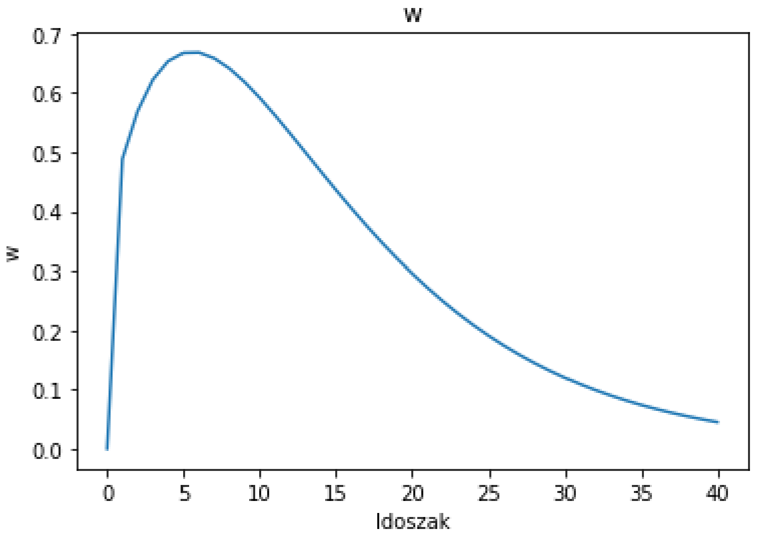





c
c
0.4
0.3
0.2
0.1
0.0
0
5
10
15
20
25
30
35
40
Idoszak


i
i
4
3
2
1
0
0
5
10
15
20
25
30
35
40
Idoszak


r
r
0.12
0.10
0.08
0.06
0.04
0.02
0.00
−0.02
0
5
10
15
20
25
30
35
40
Idoszak


w
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
w
0
5
10
15
20
25
30
35
40
Idoszak