```
> #Please do not post homework
  #Shreya Ghosh, 09-20-2021, Assignment 5
> read "/Users/shreyaghosh/Documents/M5.txt"
> Help5( )
```

RecToSeq(INI,REC,N), GrowthC(INI,REC,K) , GrowthCe(REC)
LeslieMod(SUR,FER): e.g. LeslieMod([9/10,9/10],[0,1,1]);
LeslieMat(SUR,FER); e.g. LeslieMat([9/10,9/10],[0,1,1]); **(1)**

```
> #0.
  #Conversion to canonical form: a(n) = -5·a(n-2) - 6·a(n-4)
  L := RecToSeq([1, 2, 4, 11], [0, -5, 0, -6], 1000) :
  L[1000]
```

(2)

$$1818014589793496842119263353977165955901169251300081152017301791629030009579194774209925134910767767993350034005595962441714858161276739646642515466061813117\628394165055217094548419439974932835130478675973471845469594019041097456844035403 09$$

```
> #1.
  GrowthC([1, 4, 5, 6, 3, 4, 5, 6, 7, 4], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1], 100)
```

1.999018633 **(3)**

```
> GrowthCe([1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

1.999018633 **(4)**

```
> #2.
```

$$LeslieMod\left(\left[\frac{99}{100}, \frac{99}{100}\right], \left[0, \frac{1}{2}, \frac{1}{4}\right]\right)$$

$$\left[0, \frac{99}{200}, \frac{9801}{40000}\right] \quad \textbf{(5)}$$

$$GrowthCe\left(\left[0, \frac{99}{200}, \frac{9801}{40000}\right]\right)$$

0.8795363925 **(6)**

$$LeslieMat\left(\left[\frac{99}{100}, \frac{99}{100}\right], \left[0, \frac{1}{2}, \frac{1}{4}\right]\right)$$

$$\begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{4} \\ \frac{99}{100} & 0 & 0 \\ 0 & \frac{99}{100} & 0 \end{bmatrix} \quad \textbf{(7)}$$

$$evalf\left(Eigenvalues\left(\left[\left[0, \frac{1}{2}, \frac{1}{4}\right], \left[\frac{99}{100}, 0, 0\right], \left[0, \frac{99}{100}, 0\right]\right]\right)\right)$$

(8)

$$\begin{bmatrix} 0.8795363925 \\ -0.4397681962 + 0.2918701754\,I \\ -0.4397681962 - 0.2918701754\,I \end{bmatrix} \quad (8)$$

```
> #3.
  GrowthCe([0, 0, 0, 0.16, 0.41])
```

$$0.8879729192 \quad (9)$$

```
> #4.
  with(LinearAlgebra):


> PlantGseq := proc(alpha, beta, gamma, sigma, INI, K) local REC, i, k, L, newguy:
  if not (type(INI, list) and type(K, integer) and K ≥ nops(INI)) then
   print(`bad innput`):
   RETURN(FAIL):
   fi:
  REC := [alpha·sigma·gamma, beta·sigma^2·(1 − alpha)·gamma]:

  k := nops(INI):

  L := INI:

  while nops(L) < K do
   newguy := add(REC[i]*L[-i], i = 1..k):
   L := [op(L), newguy]:
  od:
  L:
  end:
> PlantGseq(0.5, 0.25, 2.0, 0.8, [100, 80], 21)
```

[100, 80, 80.000000, 76.80000000, 74.24000000, 71.68000000, 69.22240000, 66.84672000, 64.55296000, 62.33784320, 60.19874816, 58.13305344, 56.13824246, 54.21188252, 52.35162481, 50.55520105, 48.82042081, 47.14516882, 45.52740239, 43.96514892, 42.45650352] **(10)**

```
> PlantGseq(0.6, 0.3, 2.0, 0.8, [100, 96], 21)
```

[100, 96, 107.52000, 117.9648000, 129.7612800, 142.6902221, 156.9139458, 172.5546061, 189.7544040, 208.6686153, 229.4681472, 252.3409206, 277.4935912, 305.1534130, 335.5702921, 369.0190446, 405.8018797, 446.2511298, 490.7322533, 539.6471367, 593.4377253] **(11)**

```
> #5.
  PlantGseq := proc(alpha, beta, gamma, sigma) local REC, x, i:
  REC := [alpha·sigma·gamma, beta·sigma^2·(1 − alpha)·gamma]:
  evalf([solve(1 - add(REC[i]/x^i, i = 1..nops(REC)))])[1]:

  end:
```

```
> #extinction
  PlantGseq(0.2, 0.2, 0.2, 0.2)
```

0.04000000000 **(12)**

```
> #stability
  PlantGseq(1, 1, 1, 1, 1)
```

1. **(13)**

```
> #explosion
  PlantGseq(1.25, 1.4, 1.4, 1.2, 1.3)
```

1.680000000 **(14)**

```
>
```