Contents


```
% Zain Bhaila
% Math 401
% Homework 1
```

2.2

```
M = [.3157 .947; .6314 .1263] % consumption matrix
A = eye(2) - M % I - M
eig(A) % eigenvalues of I - M
% since I - M is not invertible (eigenvalue of 0) and d=0
% the answer is any multiple of p where p is an eigenvector of M associated
% with lambda = 1
[V,D] = eig(M) % eigenvalues and eigenvectors of M
p1 = V(:,1) % production vector 1
p2 = p1 * 3 %#ok production vector 2
```

```
M =

    0.3157    0.9470
    0.6314    0.1263


A =

    0.6843   -0.9470
   -0.6314    0.8737


ans =

   -0.0000
    1.5580


V =

    0.8105   -0.7350
    0.5857    0.6781


D =
```

```
    1.0000         0
         0   -0.5580


p1 =

    0.8105
    0.5857


p2 =

    2.4316
    1.7571
```

2.5

```
M = [.22 .15 ; .16 .26] % consumption matrix

% part a
A = eye(2) - M % I - M
eig(A) % eigenvalues of I - M
% I - M is invertible and d =/= 0
% thus p = (I-M)^-1 * d
d = [120 ; 150] % external demand
p = A\d % (I-M)^-1 * d

% part b
M * p %  internal demand
% the economy is not efficient as a significant portion of the production
% goes towards internal demand

% part c
M2 = [.022 .015 ; .016 .026] % consumption matrix
A2 = eye(2) - M2 % I - M
eig(A2) % eigenvalues of I - M
% I - M is invertible and d =/= 0
% thus p = (I-M)^-1 * d
d2 = [120 ; 150] % external demand
p2 = A2\d2 % (I-M)^-1 * d
M2 * p2 % internal demand
% this economy is efficient, as a relatively small
% amount of product is used for internal demand

% part d
B = inv(A) % (I-M)^-1
% if external demand for sector 1 changes by 1 then the first entry
% in column 1 of B indicates the change of production that must occur in
% sector 1 to keep up with demand
% if external demand for sector 2 changes by 1 then the first entry
% in column 2 of B indicates the change of production that must occur in
% sector 1 to keep up with deman
```

```
M =

    0.2200    0.1500
    0.1600    0.2600


A =

    0.7800   -0.1500
   -0.1600    0.7400


ans =

    0.9162
    0.6038


d =

   120
   150


p =

  201.1931
  246.2039


ans =

   81.1931
   96.2039


M2 =

    0.0220    0.0150
    0.0160    0.0260


A2 =

    0.9780   -0.0150
   -0.0160    0.9740


ans =

    0.9916
    0.9604


d2 =
```

```
   120
   150


p2 =

  125.0929
  156.0590


ans =

    5.0929
    6.0590


B =

    1.3377    0.2711
    0.2892    1.4100
```

2.9

```
M = [.1 .06 ; .05 .12] % consumption matrix

% part a
eig(M) % show that infinite sum is valid
(eye(2) + M + M^2 + M^3 + M^4 + M^5) == (eye(2) + M + M^2 + M^3 + M^4) %#ok returns zero matr
ix if equal to the fourth digit

% part b
A = eye(2) + M + M^2 + M^3 + M^4 + M^5 %#ok matrix from part a

% part c
% we can say that (I-M)^-1 is approximately the same as
% the matrix A found in part b
```

```
M =

    0.1000    0.0600
    0.0500    0.1200


ans =

    0.0543
    0.1657


ans =

  2×2 logical array
```

```
     0     0
     0     0


A =

    1.1153    0.0760
    0.0634    1.1407
```

2.17

```
% part a
% you can find M by inverting (I-M)^-1, then
% you subtract I from the result, then multiply by -1
% M = (((I-M)^-1)^-1 - I) * -1

% part b
A = [1.06 .02 .04 ; .02 1.06 .09 ; .11 .02 1.03] % (I-M)^-1
M = (inv(A) - eye(3)) * -1 %#ok consumption matrix
```

```
A =

    1.0600    0.0200    0.0400
    0.0200    1.0600    0.0900
    0.1100    0.0200    1.0300


M =

    0.0526    0.0172    0.0353
    0.0093    0.0549    0.0822
    0.1010    0.0165    0.0238
```

2.19

```
% part a
syms x y;
M = [.1 .2 ; x .05] % consumption matrix
a = det(eye(2) - M) % determinant of I - M
solve(a == 0, x) % upper bound for x
% for x to be valid, it must be less than 4.275 (171/40)
% this is because for an economy too be sensible the determinant must be a
% positive number

% part b
M = [.1 y ; x .05] % consumption matrix
det(eye(2) - M) % determinant of I - M
% x * y must be less than 0.855 (171/200)
```

```
M =

[ 1/10,  1/5]
[    x, 1/20]


a =

171/200 - x/5


ans =

171/40


M =

[ 1/10,    y]
[    x, 1/20]


ans =

171/200 - x*y
```
