Advanced Mathematics for Engineers, Laboratory Problems

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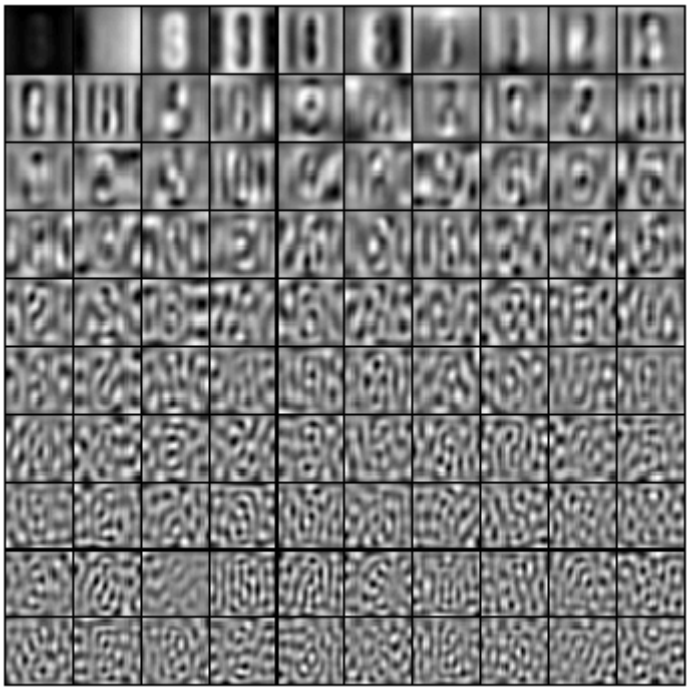
Problem 3.6

```
b)
symmetry test:
deviation = 0.0266565772348

periodicity test:
no period found.

c)
symmetry test:
deviation = 0.000162239945826

periodicity test:
no period found.

d)
a = 1, b = 1, m = 10
symmetry test:
deviation = 0.0769230769231

a = 20, b = 30, m = 100000
symmetry test:
deviation = 0.0624828117265

a = 214013, b = 2531011, m = 4294967296
symmetry test:
deviation = 0.0168803363686
```

Problem 3.7

a)

b)



c)

Original numbers

Recovered numbers

d)

50 principal components:

Original numbers

Recovered numbers

10 principal components:

Original numbers

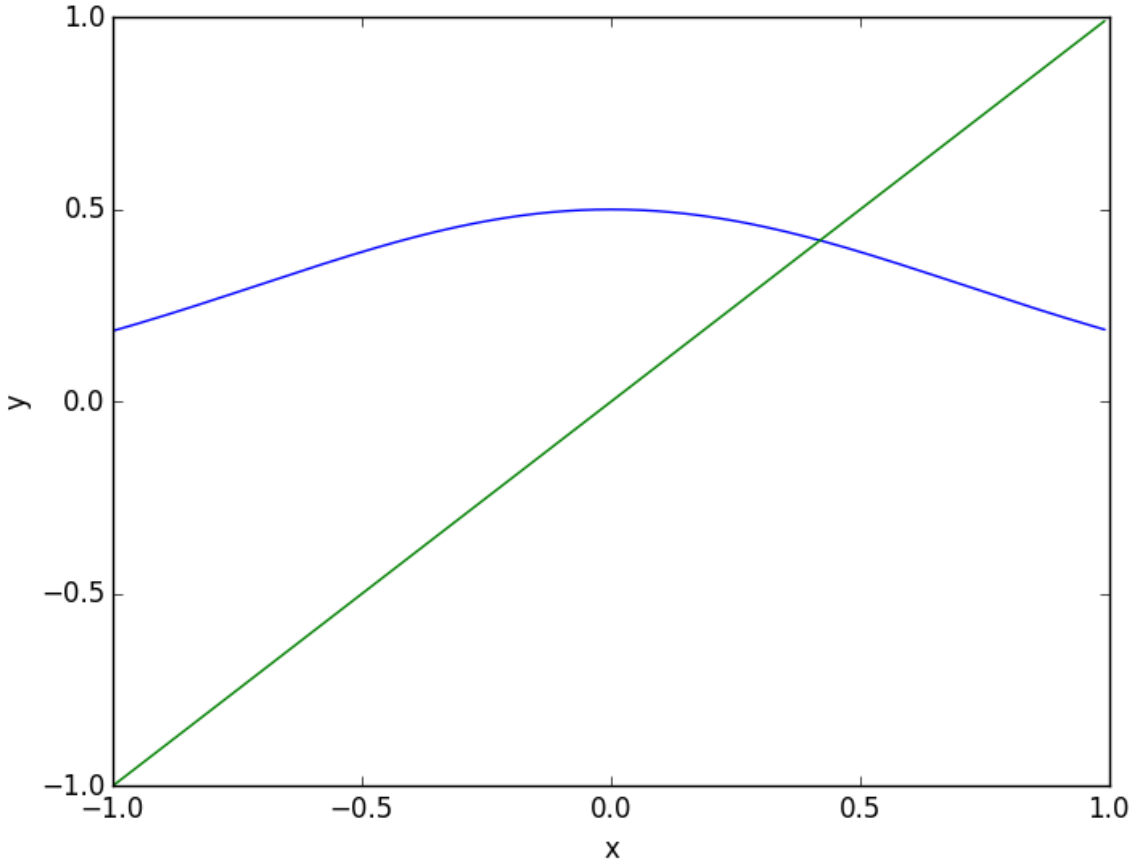
Recovered numbers

e)

Like the JPEG compression detail gets lost, especially between two area where the color contrast is high.

Problem 4.8

a)




```
b)
fixed-point iteration is applicable since 0 < L < 1 (see c))
contraction interval: [0, 1] -> [0, 1]

c)
L = 0.428881942471

d)
33 iteration steps required
```

e)
Newton's method is the fastest because it also utilizes the first derivative of the function.

Interval bisection is the slowest because by always using the middle of the interval as a bound, it reaches the root the slowest.

f)
27 steps were needed instead of the estimated 33 steps. It took less steps because the a priori estimation always asumes the worst case scenario.