# Q1

a)

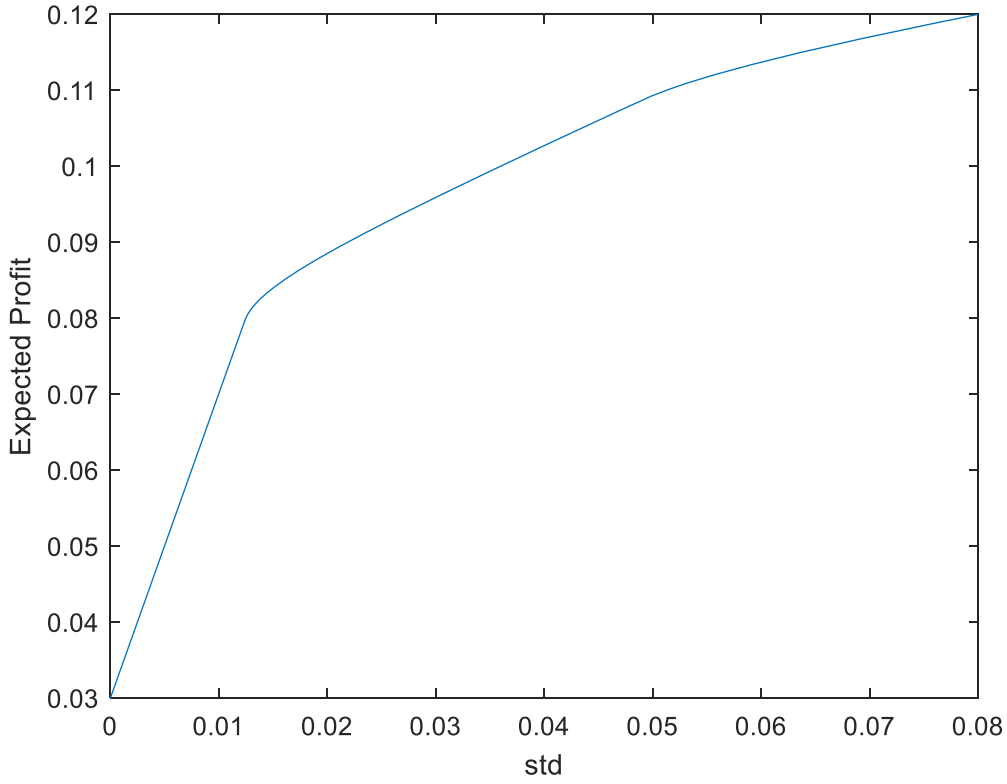

0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
Expected Profit
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
std

**Figure 1**

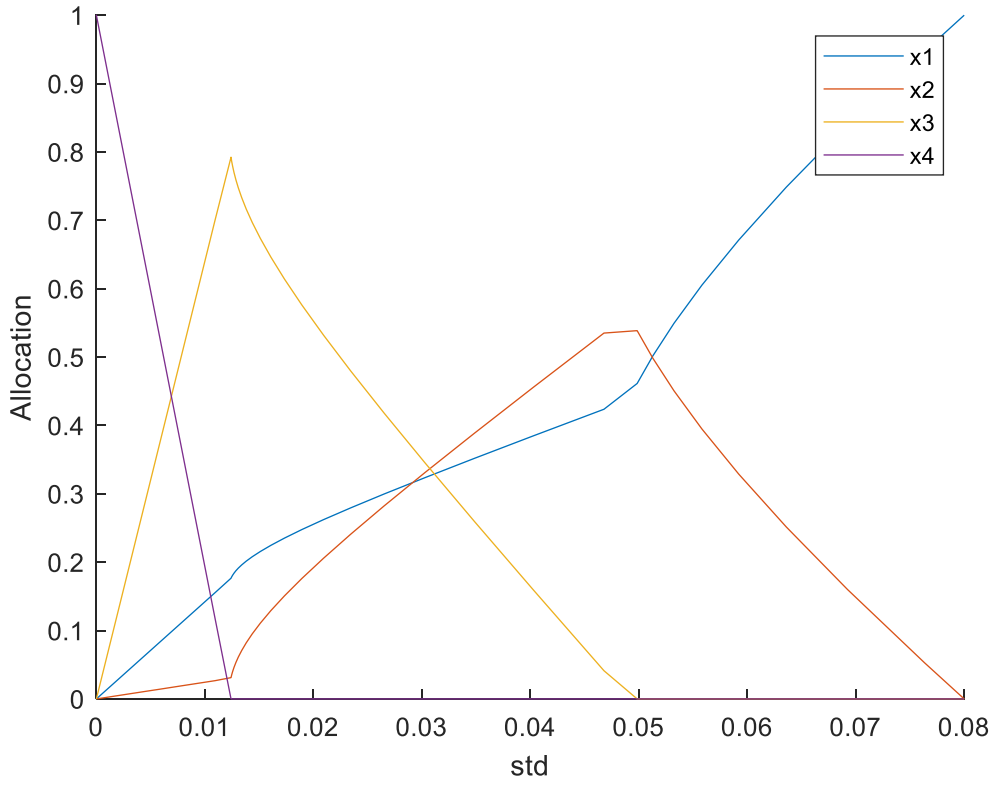
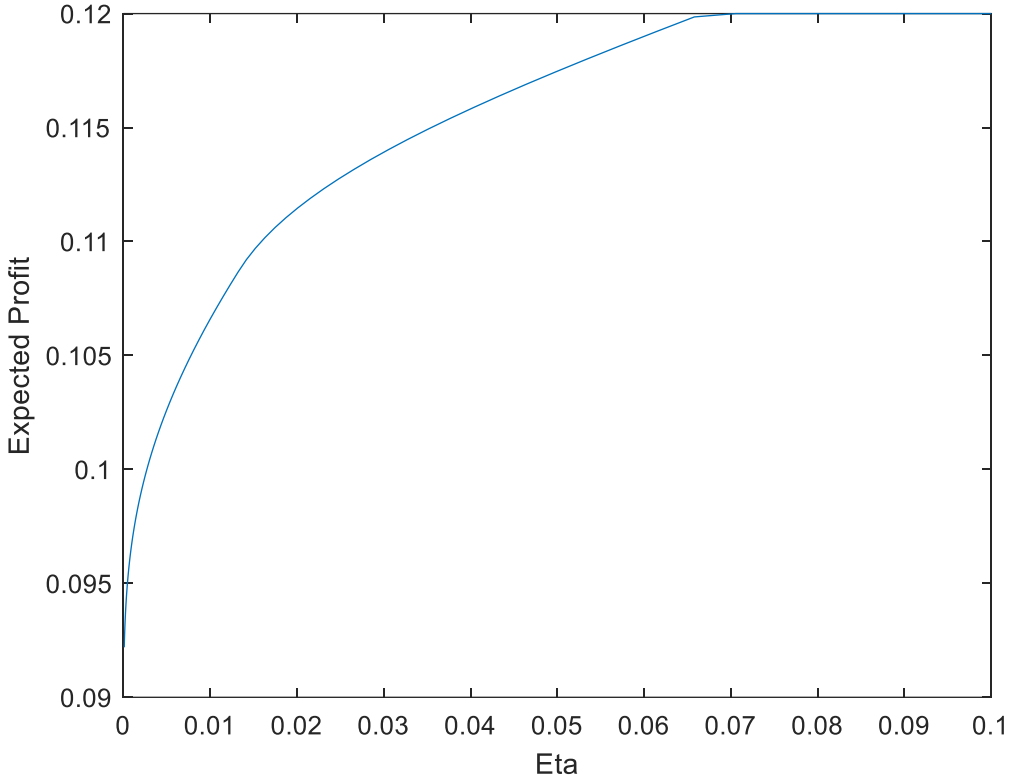
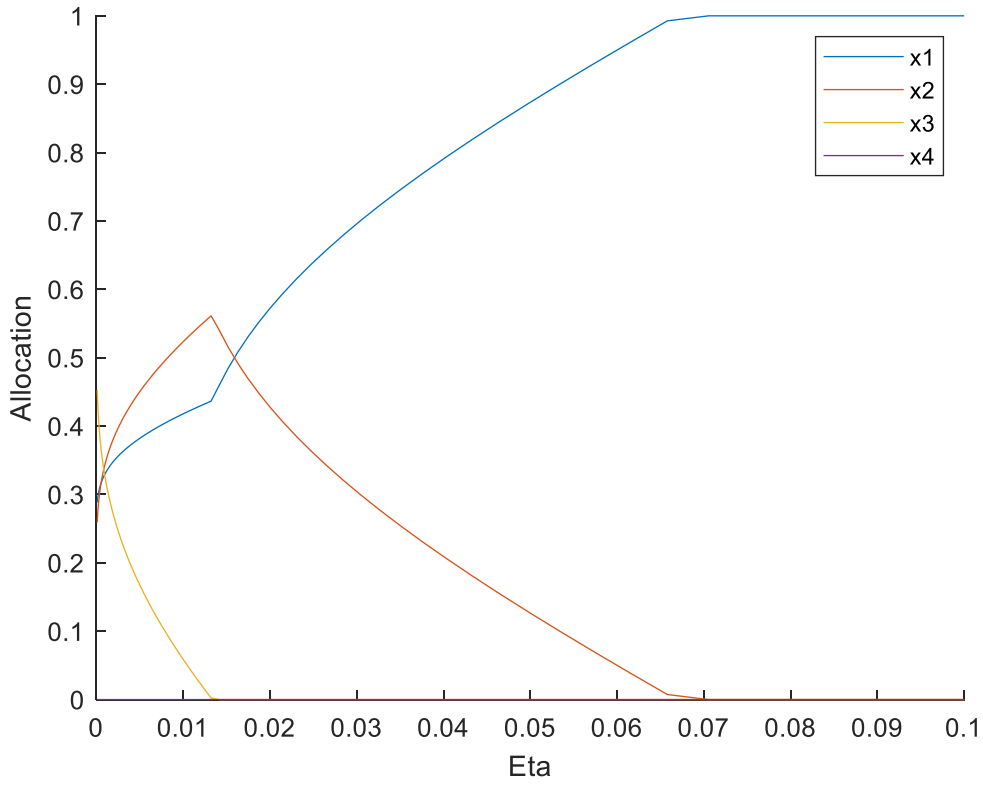

Allocation
std
x1
x2
x3
x4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08

**Figure 2**

b)


Expected Profit
0.12
0.115
0.11
0.105
0.1
0.095
0.09
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Eta


Allocation
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Eta
x1
x2
x3
x4

## Q2

### a)

```
    "unconstrained risk:0.000346
     "


ans =

    "long only risk:0.002566
     "


ans =

    "limited short risk:0.000441
     "
```

As the constraints get stricter the risk increases, obviously, since the profit is fixed, constraints increase the risk:

Risk unconstrained < Risk Risk limited short < Risk long only

### b)

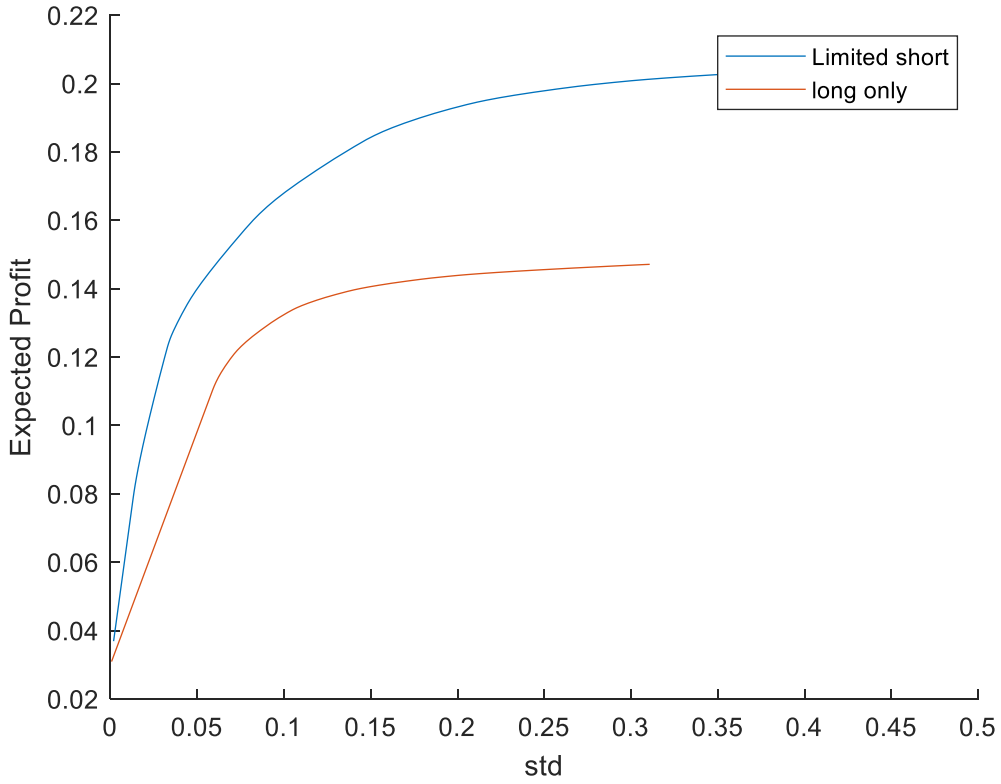



**Figure 3**

## Q3

### b)

```
ans =

    "Constant fuel time: 258.479492
     "
```

```
ans =

    "Optimum time: 213.261995
     "
```

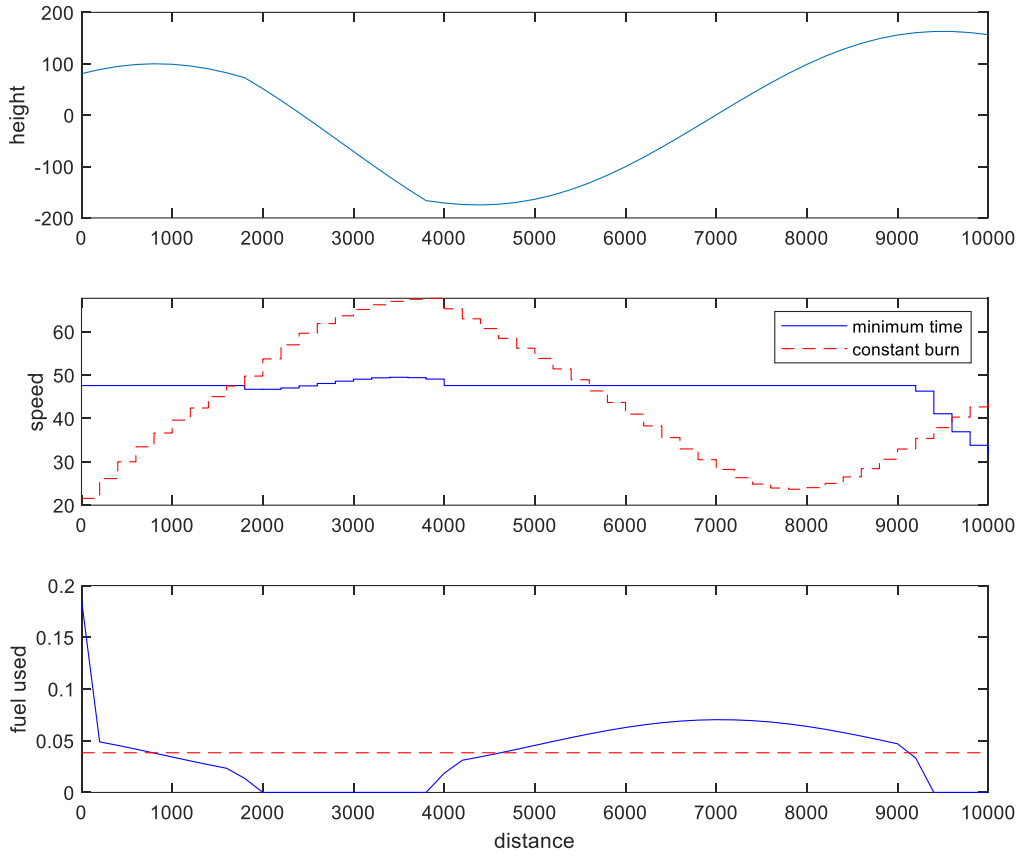



**Figure 4**

## Q4

Euclidian distance:

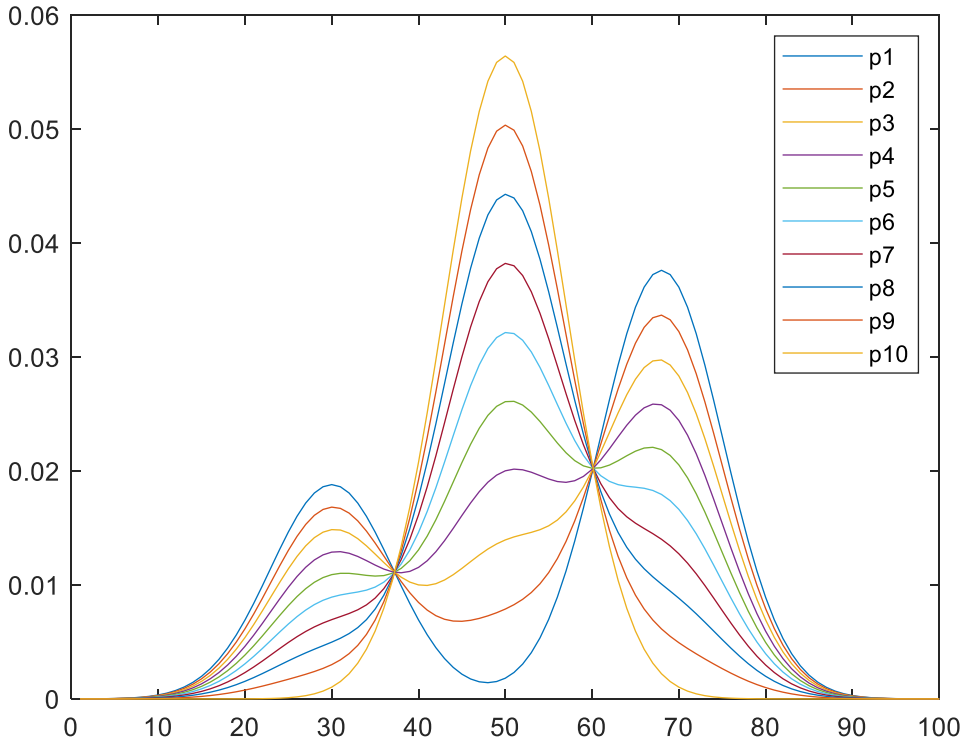



**Figure 5, Euclidian morphing**

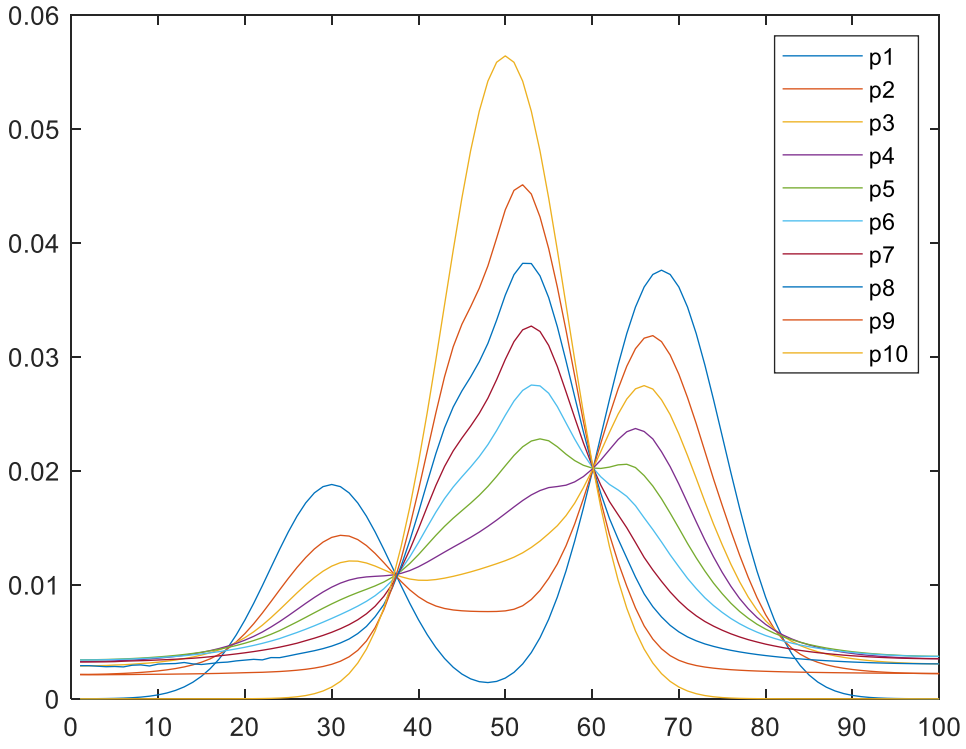



**Figure 6, Kolmogorov morphing**

## Q5

```
ans =

    "l2 distance constrained: 3.762803
     "


ans =

    "frobenius constrained: 71.306965
     "


ans =

    "l2 distance unconstrained: 4.271863
     "


ans =

    "frobenius unconstrained: 71.597853
     "
```