Lab 3: Simplex, Constrained and Optimal Control Methods Report

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# Task 1: Simplex Method

## Task 1a):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **Supply** |
| **O1** | 8 | 6 | 10 | 2000 |
| **O2** | 10 | 4 | 9 | 2500 |
| **Demand** | 1500 | 2000 | 1000 |  |

Table 1: Transportation Tableau

From table 1, the minimisation cost equations and constraints are:

Cost equations:

Constraint equations:

The Matrix/Vector:

The Transportation Tableau

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **Supply** |
| **O1** | Min (1500,2000) = 1500 |  |  | 2000-1500=500 |
| **O2** | 1500 – D1 = 0 |  |  | 2500 |
| **Demand** | 1500-1500 = 0 | 2000 | 1000 |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **Supply** |
| **O1** | 1500 | Min (500,2000) = 500 |  | 500-500 |
| **O2** | 0 | 2000 – 500 = 1500 |  | 2500-1500 |
| **Demand** | 0 | 2000 | 1000 |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **Supply** |
| **O1** | 1500 | 500 | Min (0,1000) = 0 | 0 |
| **O2** | 0 | 1500 | 1000 – 0 = 1000 | 1000-1000=0 |
| **Demand** | 0 | 0 | 1000-1000=0 |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **Supply** |
| **O1** | 1500 | 500 | 0 | 0 |
| **O2** | 0 | 1500 | 1000 | 0 |
| **Demand** | 0 | 0 | 0 |  |

## Task 1b):

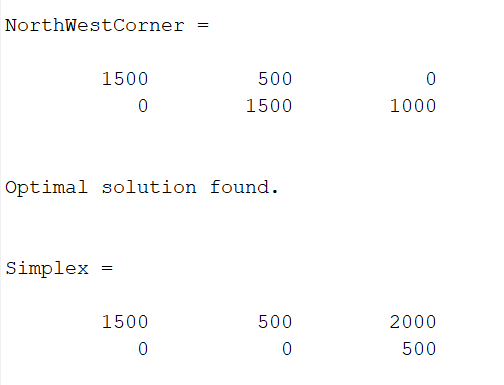
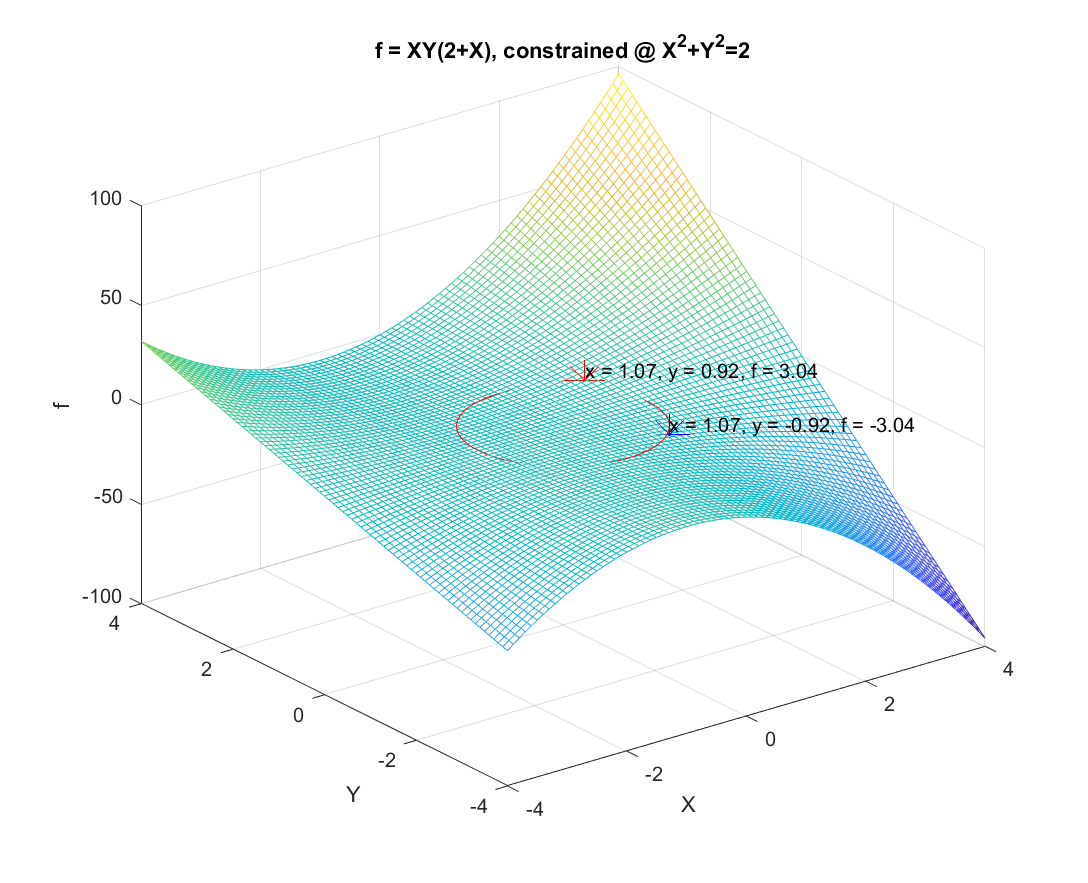


Figure 1: North-West Corner Method and Simplex

When comparing the results gained between the North West Corner Method, we can see that there is a discrepancy between the two. How North West Corner Method works is that as it starts from the North West corner and continually finds the minimum value between the demand and the supply and continually works its way to the right-hand side. This method is optimal if a fast solution is required on the stop, but what it fails to do is find the optimum solution as it does not consider the weighting of each cell. Simplex method on the other hand takes into consideration the weighting between the cells and correctly allocates the resources based on weighting.

# Task 2: Lagrange Multipliers

## Task 2a):



The red point is the maximum value for the objective function constrained by the circle and the blue point is the minimum value constrained by the circle. The max and min was determined via finding Lagrange Multiplier method and the max and min was determined by finding the largest and smallest value were determined by subbing in the x and y points determined by the Lagrange Multiplier Method.

## Task 2b):

The objective function is:

## Task 2c)

# Task 3): Karush and Kuhn and Tucker Conditions

## Task 3a)

### Case 1

### Case 2:

### Case 3:

### Case 4

## Task 3b)

### Case 1:

### Case 2:

# Task 4 Optimal Control

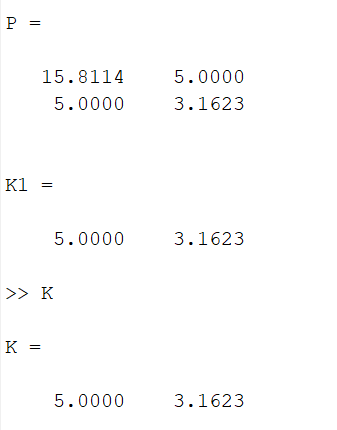
## Task 4a)

## Task 4b)

## Task 4c Part 1)

## Task 4c Part 2)

Part 11 was proved on MATLAB (See Appendix A).



Which proves equation 11.