**EVALUATING THE BIG M METHOD AND THE TWO-PHASE METHOD BY A CALCULATOR**

* **I recommend that you should use the Two-Phase method rather than the Big M method because of the calculation simplicity of the Two-Phase method when solving problems with artifical variables.**
* **The calculator we use is fx-580VNX (because of 4 available matrices with size of up to 4x4 to input !!!)**

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# A picture containing graphical user interface Description automatically generatedCHAPTER 1: REVIEW REVISED SIMPLEX METHOD

**Table

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**Let c1 = -c, we rewrite the formula:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Decision variables** | **Slack variables** | **rhs** |
|  | **cB B-1A + c1** | **cB B-1** | **cB B-1b** |
|  | **B-1A** | **B-1** | **B-1b** |

**Note: in the problem that all constraints have only sign we do not bother to consider which variables are basic variables and nonbasic variables because the decision variables are nonbasic variables and the slack variables are basic variables.**

**Example 1: Maximize**

**Step 1: Writing the standard form.**

**Step 2: Determining the initial basic variables and nonbasic variables. (This is one of the most crucial steps that you shall be written in the paper examination).**

**In this problem**, the decision variables are nonbasic variables and the slack variables are basic variables.

Let and subtituting them into 3 equations of standard form we get:

**Hence,**

**Step 3: Forming The Initial Tableau**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Iteration**  **0** | **Decision variables** | | | **Slack variables** | | |  |
|  |  |  |  |  |  | rhs |
|  | -2 | -4 | -3 | 0 | 0 | 0 | 0 |
|  | 3 | 4 | 2 | 1 | 0 | 0 | 60 |
|  | 2 | 1 | 2 | 0 | 1 | 0 | 40 |
|  | 1 | 3 | 2 | 0 | 0 | 1 | 80 |

There are 6 colored areas that are 6 regional matrices form respectively in this below tableau:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Decision variables** | **Slack variables** | **rhs** |
|  | **cB B-1A + c1** | **cB B-1** | **cB B-1b** |
|  | **B-1A** | **B-1** | **B-1b** |

**Step 4: Determining the matrices**

**There are 3 matrices always constants at each iteration.**

**A = b =**

**c = => c1 = -c =**

**There are 2 matrices always changing at each iteration.**

**s1 s2 s3**

**s1 s2 s3**

**B = cB =**

The values of **cB**  **are the coefficents in Z Function.** In this example, **at iteration 0 the values of** **cB are the coefficents of s1, s2, s3 in Z Function.**

**Step 5: Inputing matrices in calculator fx-580VNX at iteration 0.**

**MatA = A = MatB = B =**

**MatC = cB = MatD = b =**

**Step 6: Determining the entering variable and the leaving variable.**

is the entering variable and is the leaving variable.

**Step 7: Updating new values for changing matrices at iteration 1.**

**x1 s2 s3**

**x2 s2 s3**

**MatB = B = MatC = cB =**

In matrix B, we transform from the column of **s1** to the column of**x2 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of **s1** to the coefficent of**x2 in** **Z function of this example.**

**The remaining matrices are constant.**

**Step 8: Updating new values for tableau at iteration 1.**

*We should calculate in order as follows to get the best efficent performence in using calculator process.*

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA =**

**cB B-1 = MatC x MatB-1 =**

**cB B-1b = MatC x MatB-1 x MatD = 60**

**cB B-1A = MatC x MatB-1 x MatA =**

***The matrix (cB B-1A – c) = (cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 =**

**The values for each region has an unique color so that you know which matrix result will assign for the region respectively.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Iteration**  **1** | **Decision variables** | | | **Slack variables** | | |  |
|  |  |  |  |  |  | rhs |
|  | 1 | 0 | -1 | 1 | 0 | 0 | 60 |
|  | 3/4 | 1 | 1/2 | 1/4 | 0 | 0 | 15 |
|  | 5/4 | 0 | 3/2 | -1/4 | 1 | 0 | 25 |
|  | -5/4 | 0 | 1/2 | -3/4 | 0 | 1 | 35 |

**Step 9: Replicating the process until we reach the optimal condition.**

is the entering variable and is the leaving variable.

In matrix B, we transform from the column of **s2** to the column of**x3 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of **s2** to the coefficent of**x3 in** **Z function of this example.**

**x2 x3 s3**

**x2 x3 s3**

**MatB = B = MatC = cB =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA =**

**cB B-1 = MatC x MatB-1 =**

**cB B-1b = MatC x MatB-1 x MatD = 230/3**

**cB B-1A = MatC x MatB-1 x MatA =**

***(cB B-1A – c) = (cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 =**

**The values for each region has an unique color so that you know which matrix result will assign for the region respectively.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Iteration**  **2** | **Decision variables** | | | **Slack variables** | | |  |
|  |  |  |  |  |  | rhs |
|  | 11/6 | 0 | 0 | 5/6 | 2/3 | 0 | 230/3 |
|  | 1/3 | 1 | 0 | 1/3 | -1/3 | 0 | 20/3 |
|  | 5/6 | 0 | 1 | -1/6 | 2/3 | 0 | 50/3 |
|  | -5/3 | 0 | 0 | -2/3 | -1/3 | 1 | 80/3 |

**The optimal condition is reached so we stop.**

Hence, the optimal solution is at

We check again by phpsimplex.com website.

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# CHAPTER 2: BIG M METHOD

1. **Generalized the formula**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Nonbasic variables** | **Basic variables** | **rhs** |
|  | **cB B-1A + c1** | **cB B-1 + c2** | **cB B-1b** |
|  | **B-1A** | **B-1** | **B-1b** |

**Columns of the chosen basic variables will always form a unit matrix I. The arrangement of slack variables and artificial variables must be followed the order of equation in standard form.**

1. **Determining the initial nonbasic variables and basic variables**

**Example 2: Minimize**

**Maximize**

Subject to:

**Firstly, we rewrite the constraint:**

**Secondly, we write the standard form:**

**Maximize**



**Order of equations**

**Note that there are 4 equations in standard form so we have 4 basic variables. We just choose slack variables and artificial variables being basic variables and ignore the surplus variables** .

Let , subtituting them into 4 equations in standard form, we get:

Hence, , , are basic variables.

1. **Input data on calculator**

We use **STO** button on calculator to store value **M = 104**

Matrix A **is the coeffcients of decision variables in 4 equations of standard form** and **is always constant at each iteration**.

Matrix B **is the coeffcients of slack and artificial variables in 4 equations of standard form** and **is always changing at each iteration. The arrangement of slack and artificial variables followed** **the order of equations**:

**x1 x2 x3 s3**

**s1 s2 A1 A2**

**MatA = A =** **MatB = B =**

In matrix cB**,** we get the coeffcients of basic variables **in** -**Z function of this example.**

**s1 s2 A1 A2**

**MatC = cB =**

Matrix D **is the righ hand side values of 4 equations of standard form** and **is always constant at each iteration**.

**MatD = b =**

**There are 2 matrices C1 and C2 we don’t have to input in calculator and they are always constant at each iteration. In matrices C1 and C2, we get the coefficents from the equation:**

**s1 s2 A1 A2**

**x1 x2 x3 s3**

**C1 = C2 =**

1. **Calculating iteration 0**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**cB B-1b = MatC x MatB-1 x MatD = -70000 = -7\*10000 = -7M**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

**= =**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 = +**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 0 | Nonbasic variables | | | | Basic variables | | | |  |
|  |  |  |  |  |  |  |  | rhs |
| -Z | -2M+2 | -M-3 | -6M+1 | M | 0 | 0 | 0 | 0 | -7M |
|  | 3 | -2 | 1 | 0 | 1 | 0 | 0 | 0 | 5 |
|  | 1 | 3 | -4 | 0 | 0 | 1 | 0 | 0 | 9 |
|  | 1 | 0 | 5 | -1 | 0 | 0 | 1 | 0 | 1 |
|  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 6 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 1**

Updating new value for matrices B and cB

In matrix B, we transform from the column of **A1** to the column of**x3 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of **A1** to the coefficent of**x3 in** -**Z function of this example.**

**s1 s2 x3 A2**

**s1 s2 x3 A2**

**MatB = B =** **MatC = cB =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA =**

**cB B-1 = MatC x MatB-1 = = =**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**cB B-1b = MatC x MatB-1 x MatD = =**

**= =**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

**= =**

**=**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 = +**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 1 | Nonbasic variables | | | | Basic variables | | | |  |
|  |  |  |  |  |  |  |  | rhs |
| -Z |  | -M-3 | 0 |  | 0 | 0 |  | -M |  |
|  | 14/5 | -2 | 0 | 1/5 | 1 | 0 | -0.2 | 0 | 24/5 |
|  | 9/5 | 3 | 0 | -4/5 | 0 | 1 | 0.8 | 0 | 49/5 |
|  | 1/5 | 0 | 1 | -1/5 | 0 | 0 | 0.2 | 0 | 1/5 |
|  | 4/5 | 1 | 0 | 1/5 | 0 | 0 | -0.2 | 1 | 29/5 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 2**

Updating new value for matrices B and cB

In matrix B, we transform from the column of to the column of**x2 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of to the coefficent of**x2 in** -**Z function of this example.**

**s1 x2 x3 A2**

**s1 x2 x3 A2**

**MatB = B =** **MatC = cB =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA =**

**cB B-1 = MatC x MatB-1 = =**

**=**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**cB B-1b = MatC x MatB-1 x MatD = = = = =**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

**= =**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 = +**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 2 | Nonbasic variables | | | | Basic variables | | | |  |
|  |  |  |  |  |  |  |  | rhs |
| -Z |  | 0 | 0 |  | 0 |  |  | 0 |  |
|  | 4 | 0 | 0 | -1/3 | 1 | 2/3 | 1/3 | 0 | 34/3 |
|  | 3/5 | 1 | 0 | -4/15 | 0 | 1/3 | 4/15 | 0 | 49/15 |
|  | 1/5 | 0 | 1 | -1/5 | 0 | 0 | 1/5 | 0 | 1/5 |
|  | 4/5 | 0 | 0 | 7/15 | 0 | -1/3 | -7/15 | 1 | 38/15 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 3**

Updating new value for matrices B and cB

In matrix B, we transform from the column of to the column of**s3 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of **A2** to the coefficent of**s3 in** -**Z function of this example.**

**s1 x2 x3 s3**

**s1 x2 x3 s3**

**MatB = B =** **MatC = cB =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**=**

**cB B-1b = MatC x MatB-1 x MatD =**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 = +**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 3 | Nonbasic variables | | | | Basic variables | | | |  |
|  |  |  |  |  |  |  |  | rhs |
| -Z |  | 0 | 0 |  | 0 |  |  |  |  |
|  | 29/7 | 0 | 0 | 0 | 1 | 3/7 | 0 | 5/7 | 92/7 |
|  | 5/7 | 1 | 0 | 0 | 0 | 1/7 | 0 | 4/7 | 33/7 |
|  | 2/7 | 0 | 1 | 0 | 0 | -1/7 | 0 | 3/7 | 9/7 |
|  | 3/7 | 0 | 0 | 1 | 0 | -5/7 | -1 | 15/7 | 38/7 |

**The optimal condition is reached so we stop.**

Hence, the optimal solution is at

We check again by phpsimplex.com website.

Diagram

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# CHAPTER 3: TWO PHASE METHOD

1. **Formula for each phase:**

**Phase 1:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Nonbasic variables** | **Basic variables** | **rhs** |
|  | **cB B-1A** | **cB B-1 + c2** | **cB B-1b** |
|  | **B-1A** | **B-1** | **B-1b** |

**Columns of the chosen basic variables will always form a unit matrix I. The arrangement of slack variables and artificial variables must be followed the order of equation in standard form.**

**Phase 2:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Nonbasic variables** | **Basic variables** | **rhs** |
|  | **cB B-1A + c1** | **cB B-1 + c3** | **cB B-1b** |
|  | **B-1A** | **B-1** | **B-1b** |

**Changing the columns in final phase 1.**

**Renewing matrices A, B, cB and b.**

1. **Example:**

**Maximize**

Subject to:

**We write the standard form for Phase 1:**

**Maximize**



**Order of equations**

**Note that there are 3 equations in standard form so we have 3 basic variables. We just choose slack variables and artificial variables being basic variables and ignore the surplus variables** .

Let , subtituting them into 3 equations in standard form, we get:

Hence, , , are basic variables.

1. **Input matrices in calculator**

Matrix A **is the coeffcients of decision variables in 3 equations of standard form** and **is always constant at each iteration** **IN PHASE 1**.

Matrix B **is the coeffcients of slack and artificial variables in 4 equations of standard form** and **is always changing at each iteration. The arrangement of slack and artificial variables followed** **the order of equations**:

**x1 x2 x3 s2**

**s1  A1 A2**

**MatA = A =** **MatB = B =**

In matrix cB**,** we get the coeffcients of basic variables **in** **Z function of this example.**

**s1  A1 A2**

**MatC = cB =**

Matrix D **is the righ hand side values of 4 equations of standard form** and **is always constant at each iteration IN PHASE 1**.

**MatD = b =**

**There is a matrix C2 we don’t have to input in calculator and they are always constant at each iteration IN PHASE 1. In matrix C2, we get the coefficents from the equation:**

**s1 A1 A2**

**C2 =**

1. **Calculating iteration 0**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**cB B-1b = MatC x MatB-1 x MatD = -7**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 0 | Nonbasic variables | | | | Basic variables | | |  |
|  |  |  |  |  |  |  | rhs |
| Z | -6 | -2 | -1 | 1 | 0 | 0 | 0 | -7 |
|  | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 5 |
|  | 2 | -1 | 3 | -1 | 0 | 1 | 0 | 2 |
|  | 4 | 3 | -2 | 0 | 0 | 0 | 1 | 5 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 1**

Updating new value for matrices B and cB

In matrix B, we transform from the column of to the column of**x1 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of **A1** to the coefficent of**x1 in** **Z function of this example.**

**s1 x1 A2**

**s1 x1 A2**

**MatC = cB =**  **MatB = B =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**cB B-1b = MatC x MatB-1 x MatD = -1**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 1 | Nonbasic variables | | | | Basic variables | | |  |
|  |  |  |  |  |  |  | rhs |
| Z | 0 | -5 | 8 | -2 | 0 | 2 | -1 | -7 |
|  | 0 | 7/2 | -1/2 | 1/2 | 1 | -1/2 | 0 | 5 |
|  | 1 | -1/2 | 3/2 | -1/2 | 0 | 1/2 | 0 | 2 |
|  | 0 | 5 | -8 | 2 | 0 | -2 | 1 | 5 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 2**

Updating new value for matrices B and cB

In matrix B, we transform from the column of to the column of**A2 in the tableau at iteration 0.**

In matrix cB**,** we transform from the coefficent of to the coefficent of**A2 in** **Z function of this example.**

**s1 x1 x2**

**s1 x1 x2**

**MatC = cB =**  **MatB = B =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

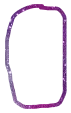
**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c2) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c2 =**

**cB B-1b = MatC x MatB-1 x MatD = 0**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iteration 2 | Nonbasic variables | | | | Basic variables | | |  |
|  |  |  |  |  |  |  | rhs |
| Z | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
|  | 0 | 0 | 51/10 | -9/10 | 1 | 9/10 | -7/10 | 33/10 |
|  | 1 | 0 | 7/10 | -3/10 | 0 | 3/10 | 1/10 | 11/10 |
|  | 0 | 1 | -8/5 | 2/5 | 0 | -2/5 | 1/5 | 1/5 |

**The optimal condition is reached. We stop Phase 1.**

1. **Preparing Phase 2**

**We drop columns A1 and A2 and choose the columns that can form the unit matrix I IN FINAL PHASE 1. It is also true for the Big M method at the iteration that firstly leaves out all artifical variables and you consider this iterarion of the Big M method as the final phase 1. The preparation from this iteration of the Big M method is the same as the final iteration in phase 1 of the Two-phase Method. In this example, we have 3 equations in standard form so the problem always have 3 basic variables. It leads to the unit matrix I in size of 3x3.**

**Considering the columns x1, x2, s1, if we rearrange them as follows: s1, x1, x2 as the order of the group in the purple circled drawing on the tableau at the final iteration of phase 1 and sort them adjacently, we can form a unit matrix I in size of 3x3. Therefore, we swap the columns to make the unit matrix I in size of 3x3 appears in the final phase 1 and let s1, x1, x2 are the initial basic variables for starting phase 2. We rewrite the tableau:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Iteration  2 | Nonbasic variables | | Basic variables | | |  |
|  |  |  |  |  | rhs |
| Z | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 51/10 | -9/10 | 1 | 0 | 0 | 33/10 |
|  | 7/10 | -3/10 | 0 | 1 | 0 | 11/10 |
|  | -8/5 | 2/5 | 0 | 0 | 1 | 1/5 |

1. **Calculating iteration 0 of phase 2**

**We renew matrices A, B, cB and b based on final Phase I tableau.**

**s1 x1 x2**

**MatA = A =**  **MatB = B =**

**MatD = b =**

In matrix cB**,** we get the coeffcients of basic variables **in** **Z function of this example.**

**s1 x1 x2**

**MatC = cB =**

**There are 2 matrices C1 and C3 we don’t have to input in calculator and they are always constant at each iteration IN PHASE 2. In matrices C1 and C3, we get the coefficents from the equation:**

**s1 x1 x2**

**x3 s2**

**c1 = c3 =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c3) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c3 =**

**cB B-1b = MatC x MatB-1 x MatD =**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 =**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Iteration 1 | Nonbasic variables | | Basic variables | | |  |
|  |  |  |  |  | rhs |
| Z | 17/10 | -13/10 | 0 | 0 | 0 | 31/10 |
|  | 51/10 | -9/10 | 1 | 0 | 0 | 33/10 |
|  | 7/10 | -3/10 | 0 | 1 | 0 | 11/10 |
|  | -8/5 | 2/5 | 0 | 0 | 1 | 1/5 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 1 of phase 2**

Updating new value for matrices B and cB

In matrix B, we transform from the column of to the column of**x2 in the tableau at iteration 0 IN PHASE 2.**

**s1 x1 s2**

**MatB = B =**

In matrix cB**,** we transform from the coefficent of to the coefficent of**x2 in** **Z function of this example.**

**s1 x1 s2**

**MatC = cB =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c3) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c3 =**

**cB B-1b = MatC x MatB-1 x MatD =**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 =**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Iteration 1 | Nonbasic variables | | Basic variables | | |  |
|  |  |  |  |  | rhs |
| Z | -7/2 | 0 | 0 | 0 | 13/4 | 15/4 |
|  | 3/2 | 0 | 1 | 0 | 9/4 | 15/4 |
|  | -1/2 | 0 | 0 | 1 | 3/4 | 5/4 |
|  | -4 | 1 | 0 | 0 | 5/2 | 1/2 |

is the entering variable and is the leaving variable.

1. **Calculating iteration 2 of phase 2**

Updating new value for matrices B and cB

In matrix B, we transform from the column of to the column of**x3 in the tableau at iteration 0 IN PHASE 2.**

**x3 x1 s2**

**MatB = B =**

In matrix cB**,** we transform from the coefficent of to the coefficent of**x3 in** **Z function of this example.**

**x3 x1 s2**

**MatC = cB =**

**B-1 = MatB-1 =**

**B-1b = MatB-1 x MatD =**

**B-1A = MatB-1 x MatA = MatA = A =**

**cB B-1 = MatC x MatB-1 =**

***(cB B-1 + c3) we calulate in mind and don’t need to use calculator.***

**cB B-1+ c3 =**

**cB B-1b = MatC x MatB-1 x MatD =**

**cB B-1A = MatC x MatB-1 x MatA**

**=**

***(cB B-1A + c1) we calulate in mind and don’t need to use calculator.***

**cB B-1A + c1 =**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Iteration 2 | Nonbasic variables | | Basic variables | | |  |
|  |  |  |  |  | rhs |
| Z | 0 | 0 | 7/3 | 0 | 17/2 | 25/2 |
|  | 1 | 0 | 2/3 | 0 | 3/2 | 5/2 |
|  | 0 | 0 | 1/3 | 1 | 3/2 | 5/2 |
|  | 0 | 1 | 8/3 | 0 | 17/2 | 21/2 |

**The optimal condition is reached so we stop.**

Hence, the optimal solution is at

We check again by phpsimplex.com website.

**Diagram

Description automatically generated**

**Graphical user interface, text, application, email

Description automatically generated**

# CHAPTER 4: FILLING OUT THE TABLEAU

**Let take back the example in chapter Big M method**

**Maximize**

Subject to:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Unknown iteration |  | | | |  | | | |  |
|  |  |  |  |  |  |  |  | rhs |
| Z |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Firstly, we write the standard form and determine which variables are basic variables and nonbasic variables. After that, rearranging the columns of this tableau problem so that they match the order of columns in tableau at iteration 0. We know the order , so we easily find the matrix B and cB.

Using revised simplex method to fill out the tableau.

This tableau is at iteration 2 of the example in chapter Big M Method.