

GRAPH THEORY AND OR PROBLEMS SOLVE USING TORA SOFTWARE

SUBMITTED BY:

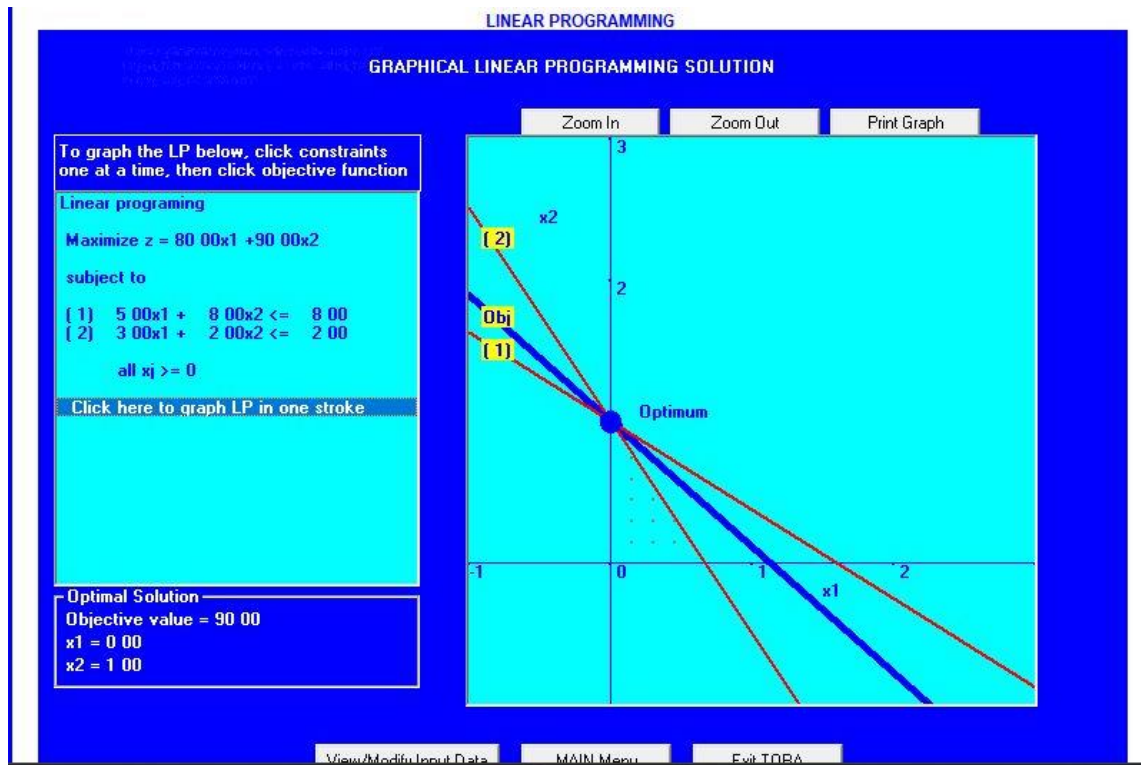
SANOOP PHILIP

REGISTER NUMBER:

22PMC148

TEMPORARY-ORDERSD ROUTING ALGORITHM (TORA)

1.Linear Programming graphical solution



File EditGrid

LINEAR PROGRAMMING

Problem Title:

Nbr. of Variables:

No. of Constraints:

INPUT GRID - LINEAR PROGRAMMING

	x1	x2	Enter <, >, or =	R.H.S.
Var. Name	x1	y1		
Maximize	80.00	90.00		
Constr 1	5.00	8.00	<=	8.00
Constr 2	3.00	2.00	<=	2.00
Lower Bound	0.00	0.00		
Upper Bound	infinity	infinity		
Unrestr'd (y/n)?	n	n		

2.Linear programming simplex method.

LINEAR PROGRAMMING

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Sunday, May 07, 2023 15:09

SIMPLEX TABLEAU - (Starting All-Slack Method)

Title: simplex method (Maximize)

Steps for generating NEXT tableau from CURRENT one:

1. ENTERING variable: Click a NONBASIC variable (if correct, column turns green)
2. LEAVING variable: Click a BASIC variable (if correct, row turns red)
3. Click command button NEXT ITERATION (or ALL ITERATIONS) – This step may be executed without Steps 1 and/or 2.

Next Iteration All Iterations Write to Printer

Iteration 1	x1	x2	sx3	sx4	sx5	sx6	Solution
Basic	x1	x2	sx3	sx4	sx5	sx6	
z (max)	7.00	-6.00	0.00	0.00	0.00	0.00	0.00
sx3	9.00	6.00	1.00	0.00	0.00	0.00	26.00
sx4	3.00	4.00	0.00	1.00	0.00	0.00	8.00
sx5	3.00	3.00	0.00	0.00	1.00	0.00	3.00
sx6	0.00	0.00	0.00	0.00	0.00	1.00	3.00
Lower Bound	0.00	0.00					
Upper Bound	infinity	infinity					
Unrestr'd (y/n)?	n	n					

Iteration 2 is optimal

Iteration 2	x1	x2	sx3	sx4	sx5	sx6	Solution
Basic	x1	x2	sx3	sx4	sx5	sx6	
z (max)	0.00	1.00	0.00	0.00	2.33	0.00	7.00
sx3	0.00	-3.00	1.00	0.00	-3.00	0.00	17.00
sx4	0.00	1.00	0.00	1.00	-1.00	0.00	5.00
x1	1.00	1.00	0.00	0.00	0.33	0.00	1.00
sx6	0.00	3.00	0.00	0.00	0.00	1.00	3.00

View/Modify Input Data MAIN Menu Exit TORA

File EditGrid

LINEAR PROGRAMMING

Problem Title: **simplex method**

Nbr. of Variables: **2**

No. of Constraints: **4**

Editing Grid:
 >>Click Maximize(Minimize)-cell to change it to Minimize(Maximize)
 >>To DELETE, INSERT, COPY, or PASTE a column(row), click heading cell of target column(row), then invoke pull-down EditGrid menu
 >>For INSERT mode, a single(double) click of target row/column will place new row/column after(before) target row/column.

INPUT GRID - LINEAR PROGRAMMING

	x1	x2	Enter <, >, or =	R.H.S.
Var. Name	x1	x2		
Maximize	7.00	6.00		
Constr 1	9.00	6.00	<=	26.00
Constr 2	3.00	4.00	<=	8.00
Constr 3	3.00	3.00	<=	3.00
Constr 4	0.00	3.00	<=	3.00
Lower Bound	0.00	0.00		
Upper Bound	infinity	infinity		
Unrestr'd (y/n)?	n	n		

3.Linear programming transportation method.

TRANSPORTATION MODEL

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TRANSPORTATION TABLEAU - (Least Cost Method)

Title: Transportation –(minimum cost)

Steps for generating transportation tableaus:

1. (Optional step) Initialize ONE of the simplex multiplier ($u_1, u_2, \dots, v_1, v_2 \dots$) to zero value (default $u_1 = 0$)
2. Click (in any order) the cells defining the change-of-basis loop (if correct, cell changes color)
3. Click command button NEXT ITERATION (or ALL ITERATIONS) – This step may be executed without Step 2

--Initialize u or v--
u1=0

Optimal Tableau

Iteration 3 is optimal

OK

Iter 1	ObjVal = 555.00	Name				D4	D5	Supply
S1	$u_1=0.00$					8.00	9.00	20
S2	$u_2=1.00$		22	8		5.00	8.00	30
S3	$u_3=32.00$		7.00	11.00	20.00	40.00	3.00	15
S4	$u_4=1.00$		28.00	23.00	14.00	0.00	0.00	13
			2.00	1.00	9.00	14.00	16.00	
			0.00	0.00	-8.00	-7.00	-46.00	

View/Modify Input Data MAIN Menu Exit TORA

File EditGrid

TRANSPORTATION MODEL

Problem Title:

No. of Sources:

No. of Dest'ns:

Editing Grid:

>>To DELETE, INSERT, COPY, or PASTE a column(row), click heading cell of target column(row), then invoke pull-down EditGrid menu

>>For INSERT mode, a single(double) click of target row/column will place new row/column after(before) target row/column.

INPUT GRID - TRANSPORTATION

	S/D Name	D1	D2	D3	D4	D5	Supply
S1		3.00	4.00	6.00	8.00	9.00	20
S2		2.00	10.00	1.00	5.00	8.00	30
S3		7.00	11.00	20.00	40.00	3.00	15
S4		2.00	1.00	9.00	14.00	16.00	13
Demand							

TRANSPORTATION MODEL

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TRANSPORTATION TABLEAU - (North-West Corner Method)

Title: Transportation –(minimum cost)

Steps for generating transportation tableaus:

1. (Optional step) Initialize ONE of the simplex multiplier ($u_1, u_2, \dots, v_1, v_2, \dots$) to zero value (default $u_1 = 0$)
2. Click (in any order) the cells defining the change-of-basis loop (if correct, cell changes color)
3. Click command button NEXT ITERATION (or ALL ITERATIONS) – This step may be executed without Step 2

- Initialize u or v -
u1=0

Optimal Tableau X

Iteration 6 is optimal

OK

Iter 1	ObjVal = 0.00					D4	D5	D6	Supply
	Name							DummyD	
		$v_1=3.00$					$v_5=9.00$	$v_6=0.00$	
S1		$u_1=0.00$	0			0	20		20
S2		$u_2=0.00$						30	30
S3		$u_3=0.00$						15	15
S4		$u_4=0.00$						13	13

View/Modify Input Data
MAIN Menu
Exit TORA

TRANSPORTATION MODEL

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TRANSPORTATION TABLEAU - (Vogel's Method)

Title: Transportation –(minimum cost)

Steps for generating transportation tableaus:

1. (Optional step) Initialize ONE of the simplex multiplier ($u_1, u_2, \dots, v_1, v_2, \dots$) to zero value (default $u_1 = 0$)
2. Click (in any order) the cells defining the change-of-basis loop (if correct, cell changes color)
3. Click command button NEXT ITERATION (or ALL ITERATIONS) – This step may be executed without Step 2

- Initialize u or v -
u1=0

Optimal Tableau X

Iteration 2 is optimal

OK

Iter 1	ObjVal = 303.00					D4	D5	Supply
	Name							
S1		$u_1=0.00$				18		20
S2		$u_2=-1.00$	22	8				30
S3		$u_3=4.00$	9				6	15
S4		$u_4=-1.00$	7	6				13

View/Modify Input Data
MAIN Menu
Exit TORA

4.Spanning tree

NETWORK MODELS

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MINIMAL SPANNING TREE OUTPUT SUMMARY

Drop-down list (or assume default N1)
Iteration (or ALL ITERATIONS)

Next Iteration All Iterations Write to Printer

length = 24.00

0. Start at node N1
1. Connect N2 [B] to N1 [A]: Length = 2.00
2. Connect N4 [D] to N2 [B]: Length = 4.00
3. Connect N3 [C] to N1 [A]: Length = 5.00
4. Connect N6 [F] to N4 [D]: Length = 6.00
5. Connect N5 [E] to N3 [C]: Length = 7.00

View/Modify Input Data MAIN Menu Exit TORA

File EditGrid

NETWORK MODELS

Problem Title: Minimum spanning Tree

No. of Nodes: 6

Editing Grid:
>>To DELETE, INSERT, COPY, or PASTE a column(row), click heading cell of target column(row), then invoke pull-down EditGrid menu
>>For INSERT mode, a single(double) click of target row/column will place new row/column after(before) target row/column.

INPUT GRID - MINIMAL SPANNING TREE

☒ Check here if network is symmetrical

		N1	N2	N3	N4	N5	N6
	Node Name	A	B	C	D	E	F
N1	A		2.00	5.00	infinity	9.00	infinity
N2	B	2.00		7.00	4.00	infinity	infinity
N3	C	5.00	7.00		9.00	7.00	infinity
N4	D	infinity	4.00	9.00		infinity	6.00
N5	E	9.00	infinity	7.00	infinity		10.00
N6	F	infinity	infinity	infinity	6.00	10.00	

5. CPM

File EditGrid

PROJECT PLANNING -- PERT/CPM

Problem Title:

Editing Grid:
 >>To DELETE, INSERT, COPY, or PASTE a column(row), click heading cell of target column(row), then invoke pull-down EditGrid menu
 >>For INSERT mode, a single(double) click of target row/column will place new row/column after(before) target row/column.

INPUT GRID - PERT (PROGRAM EVALUATION & REVIEW TECHNIQUE)

	From Node	To Node	Activity Symbol	a	m	b
1	1	2	A	3 00	5 00	7 00
2	1	3	B	4 00	6 00	8 00
3	2	3	C	1 00	3 00	5 00
4	2	4	D	5 00	8 00	11 00
5	3	5	E	1 00	2 00	3 00
6	3	6	F	9 00	11 00	13 00
7	4	5	DUMMY	0 00	0 00	0 00
8	4	6	G	1 00	1 00	1 00
9	5	6	H	11 00	13 00	14 00

PROJECT PLANNING -- PERT/CPM

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PROJECT PLANNING - CPM

Select Output Option

Next Step All Steps Write to Printer

Title: cpm

SOLUTION STEPS

Forward Pass			Backward Pass		
Step	Node	Earliest Time	Step	Node	Latest Time
1	1	0 00	11	10	25 00
2	2	6 00	12	7	20 00
3	3	10 00	13	4	17 00
4	4	17 00	14	3	10 00
5	5	2 00	15	6	14 00
6	6	13 00	16	5	4 00
7	7	20 00	17	9	15 00
8	8	8 00	18	8	11 00
9	9	12 00	19	2	6 00
10	10	25 00	20	1	0 00
Forward pass completed			Backward pass completed		
Activity	Duration	Earliest Start	Latest Completion	Total Float	Free Float
A	6 00	0 00	6 00	0 00	0 00
G	2 00	0 00	4 00	2 00	0 00
H	12 00	0 00	12 00	12 00	0 00

View/Modify Input Data MAIN Menu Exit TORA

PROJECT PLANNING -- PERT/CPM

Problem Title: **cpm**

Editing Grid:

>>To DELETE, INSERT, COPY, or PASTE a column(row), click heading cell of target column(row), then invoke pull-down EditGrid menu
 >>For INSERT mode, a single(double) click of target row/column will place new row/column after(before) target row/column.

INPUT GRID - CPM (CRITICAL PATH METHOD)

Row	From Node	To Node	Activity Symbol	Duration
1	1	2	A	6 00
2	1	5	G	2 00
3	1	6	J	13 00
4	2	3	B	4 00
5	2	4	K	9 00
6	2	8	D	2 00
7	3	4	C	7 00
8	4	7	L	3 00
9	5	6	H	10 00
10	6	7	I	6 00
11	7	10	M	5 00
12	8	9	E	4 00
13	9	10	F	10 00

6.PERT

PROJECT PLANNING -- PERT/CPM

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PROJECT PLANNING - PERT

Select Output Option

PERT Calculations

Next Step

All Steps

Write to Printer

Title: pert

PATH MEAN AND STD. DEVIATION

Node	Longest Path Based on Mean Durations	Mean Duration	Std. Deviation
2	1- 2	5 00	0 67
3	1- 2- 3	8 00	0 94
4	1- 2- 4	13 00	1 20
5	1- 2- 4- 5	13 00	1 20
6	1- 2- 4- 5- 6	25 83	1 30

View/Modify Input Data

MAIN Menu

Exit TORA