

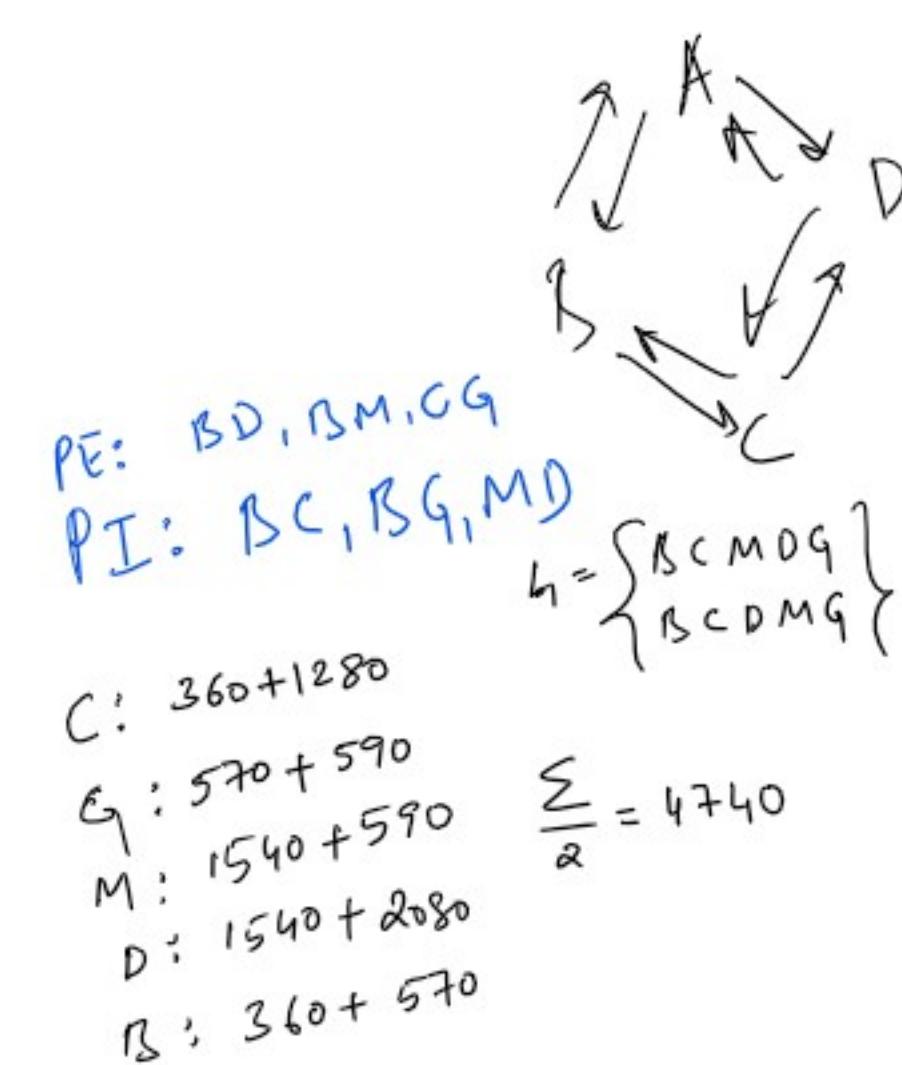
TSP BnB starts with a selection of $2N$ (directed/oneway) edges that satisfy the following condition (invariant):

There are N cities.

Each city contributes exactly 2 outgoing edges.

There are a total of $2N$ edges that guarantee a lower bound on the tour cost.

The $2N$ edges represent a partial solution (zero or more fragments of a tour). A partial solution represents a set of tours, as demonstrated in TSP BnB Part 1.



	Chennai	Goa	Mumbai	Delhi	Bangalore
Chennai	-	800	1280	2190	360
Goa	800	-	590	2080	570
Mumbai	1280	590	-	1540	1210
Delhi	2190	2080	1540	-	2434
Bangalore	360	570	1210	2434	-

CB	BG	GM	CG	MB
360	570	590	800	1210
CM	MD	GD	CD	DB
1280	1540	2080	2190	2434

To create a_1 (S_0, CB), make a copy of the $2N$ edges in S_0 and update the edges.

7) The number of permanently included segments in a_1 (S_0, CB) are _____.

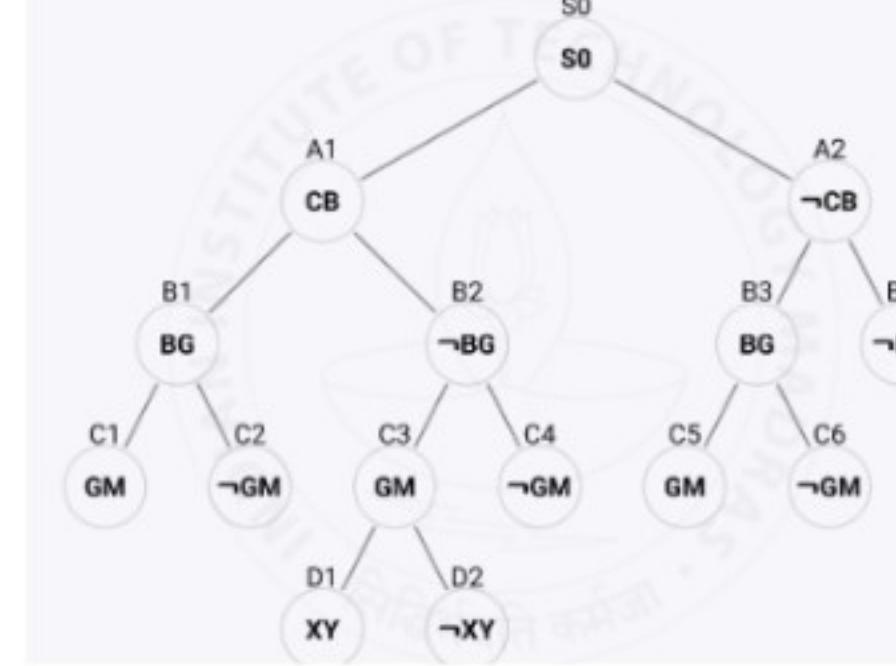
$$S_2 = \frac{5 \times 4}{2} = 10 \text{ segments}$$

$$a_1 = \left\{ \begin{array}{l} CB \text{ MDG} \\ CB \text{ MG D} \\ CB \text{ DMG} \\ BC \text{ MDG} \\ BC \text{ MG D} \\ BC \text{ DMG} \end{array} \right\}$$

$$\begin{array}{ll} CB & MD \\ CM & MG \\ CD & D \\ CG & DG \\ BM & BD \\ BD & BG \\ BG & BG \end{array}$$

10) The number of default edges in a_1 (S_0, CB) are _____.

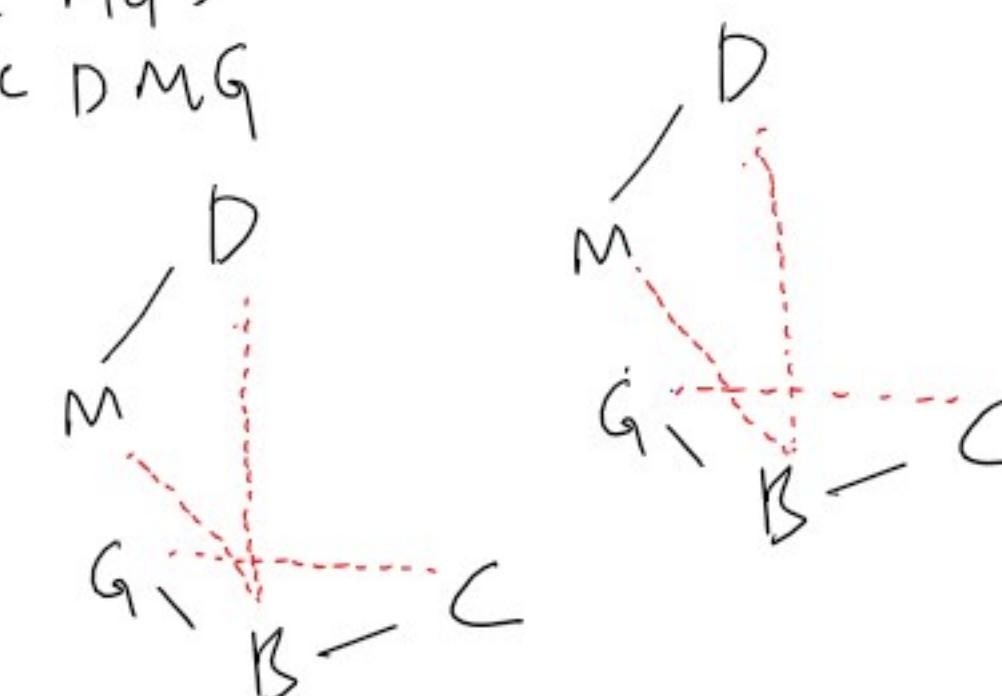
D
M
G
C — B



To create b_1 (S_0, CB, BG), make a copy of the $2N$ edges in a_1 (S_0, CB) and update the edges.

14) The PI segments in b_1 (S_0, CB, BG) are _____.

$$a_1 = \left\{ \begin{array}{l} CB \text{ MDG} \\ CB \text{ MG D} \\ CB \text{ DMG} \\ BC \text{ MDG} \\ BC \text{ MG D} \\ BC \text{ DMG} \end{array} \right\} \quad b_1 = \left\{ \begin{array}{l} BC \text{ MDG} \\ BC \text{ DMG} \end{array} \right\}$$



PI	PE	default
<input type="checkbox"/> BD	<input checked="" type="checkbox"/> BD	<input type="checkbox"/> BC
<input type="checkbox"/> BM	<input checked="" type="checkbox"/> BM	<input type="checkbox"/> BG
<input checked="" type="checkbox"/> BG	<input type="checkbox"/> BG	<input type="checkbox"/> CB
<input checked="" type="checkbox"/> CB	<input type="checkbox"/> CB	<input checked="" type="checkbox"/> CM
<input type="checkbox"/> CD	<input type="checkbox"/> CD	<input checked="" type="checkbox"/> DG
<input type="checkbox"/> CG	<input checked="" type="checkbox"/> CG	<input type="checkbox"/> DM
<input type="checkbox"/> CM	<input type="checkbox"/> CM	<input type="checkbox"/> GB
<input checked="" type="checkbox"/> DM	<input type="checkbox"/> DM	<input checked="" type="checkbox"/> GM
<input type="checkbox"/> GD	<input type="checkbox"/> GD	<input type="checkbox"/> MD
<input type="checkbox"/> GM	<input type="checkbox"/> GM	<input checked="" type="checkbox"/> MG

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Is CD also a default edge even though its not in the given options?

{CB, BG} implies {DM, ~CG, ~BD, ~BM}

Therefore,

PI segments = {CB, BG, DM}

PE segments = {~CG, ~BD, ~BM}

To fulfill the $2N$ edges invariant, each of the cities {C, G, D, M} need exactly one more outgoing edge which is cheapest allowable edge that we call default edge for the purpose of providing a lower bound estimate.

In this case, each of the cities {C, G, D, M} need exactly one default edge to fulfill the $2N$ edges invariant.

- Instructor

	Chennai	Goa	Mumbai	Delhi	Bangalore
Chennai	-	800	1280	2190	360
Goa	800	-	590	2080	570
Mumbai	1280	590	-	1540	1210
Delhi	2190	2080	1540	-	2434
Bangalore	360	570	1210	2434	-

$$A_1 = \left\{ \begin{array}{l} CBMDG \\ CBMGD \\ CBDMG \\ BCMDG \\ BCMGD \\ BCDMG \end{array} \right\}$$

$$(S_0, CB, \neg BG) \\ b_2 = \left\{ \begin{array}{l} CBMDG \\ CBMGD \\ CBDMG \\ BCMGD \end{array} \right\}$$

- 19) The PI edges in b2 ($S_0, CB, \neg BG$)
- BC
 - BG
 - CB
 - CG
 - GB
 - GC

- 20) The PE edges in b2 ($S_0, CB, \neg BG$)
- BC
 - BG
 - CB
 - CG
 - GB
 - GC

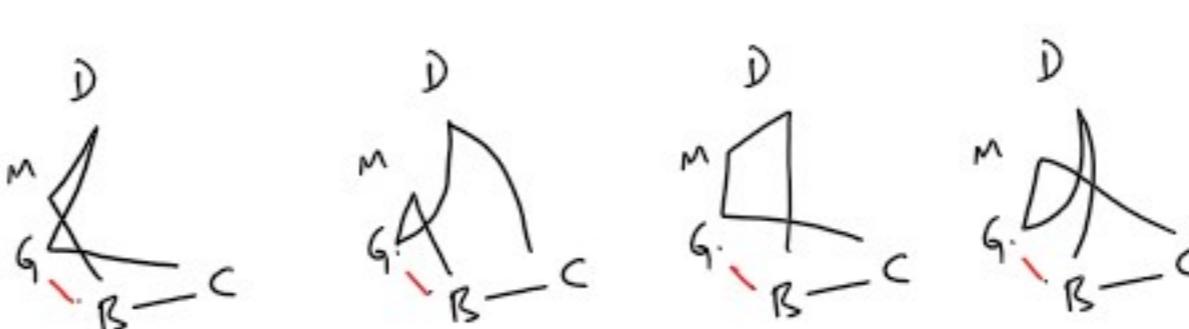
doubt

PI: BC, CB

PE: BG, GB

21) In b_2 ($S_0, CB, \neg BG$), the segment BG was replaced by the default edges.

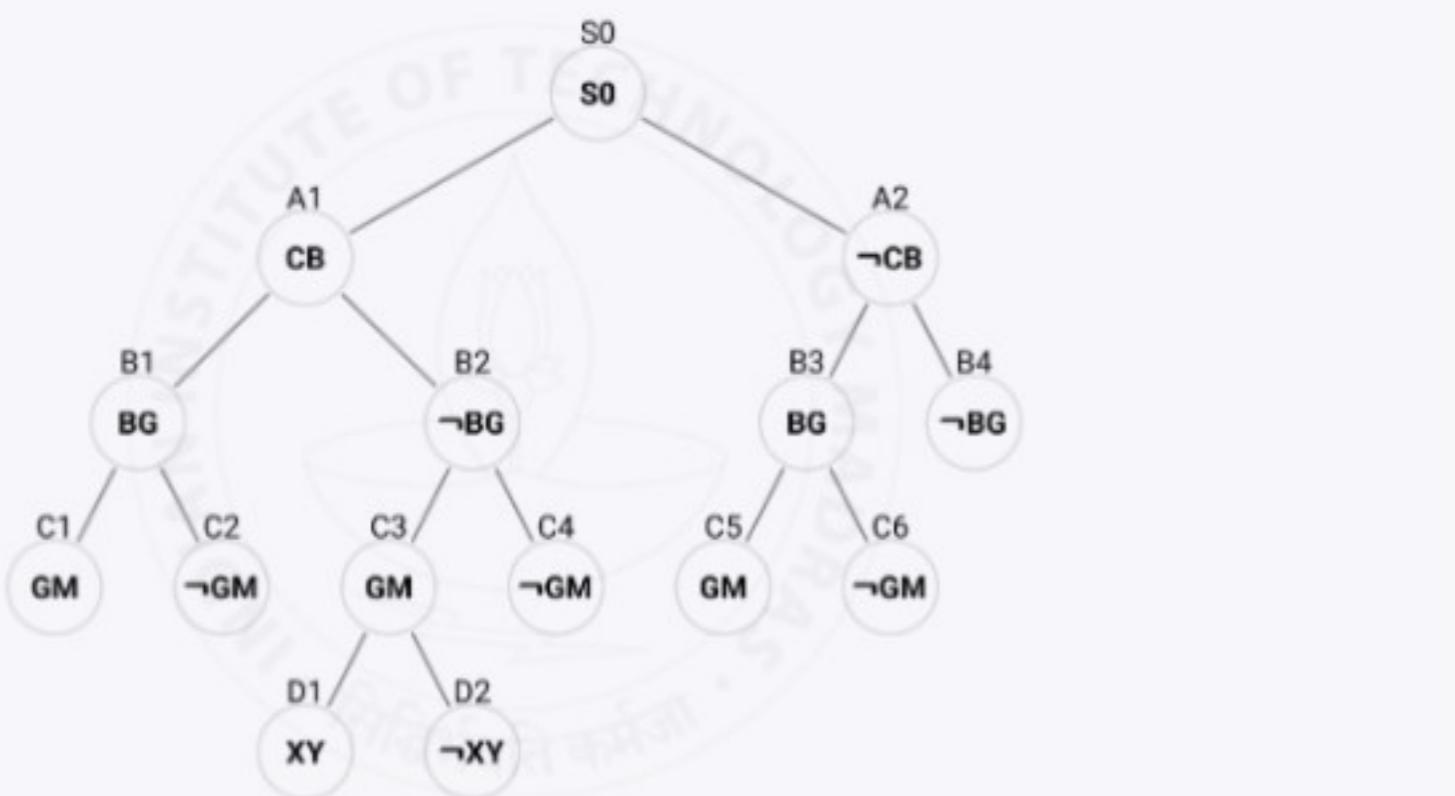
- BM
- CG
- GC
- MB



	Chennai	Goa	Mumbai	Delhi	Bangalore
Chennai	-	800	1280	2190	360
Goa	800	-	590	2080	570
Mumbai	1280	590	-	1540	1210
Delhi	2190	2080	1540	-	2434
Bangalore	360	570	1210	2434	-

	CB	BG	GM	CG	MB
CB	360	570	590	800	1210
BG	570	590	800	1210	1210
GM	590	800	1210	1210	1210
CG	800	1210	1210	1210	1210
MB	1210	1210	1210	1210	1210

	CM	MD	GD	CD	DB
CM	1280	1540	2080	2190	2434
MD	1540	2080	2190	2190	2434
GD	2080	2190	2190	2190	2434
CD	2190	2190	2190	2190	2434
DB	2434	2434	2434	2434	-



Bangalore now.
starting 2 default
From B → C₃₆₀

Now BG is P.E

Next default is M

So BM is new default

Goa now
starting 2 default
G → B₅₇₀ M₅₉₀
Now GB is P.E
Next default is C
so GC is next default

why not CG

∴ asking for edges.

$(S_0, CB, \sim BG)$

$b_2 = \{$

- $CBMDG$
- $CBMGD$
- $CBDMG$
- $BCLMGD$

$\}$

$c_4 = \{$

- $CBMDG$

$\}$

To create c_4 ($S_0, CB, \sim BG, \sim GM$), make a copy of the $2N$ edges in b_2 ($S_0, CB, \sim BG$) and update the edges.

23) In c_4 ($S_0, CB, \sim BG, \sim GM$), infer as much as possible then list all the PI segments.

- BD
- BG
- BM
- CB
- CD
- CG
- CM
- DG
- DM
- GM

24) In c_4 ($S_0, CB, \sim BG, \sim GM$), infer as much as possible then list all the PE segments.

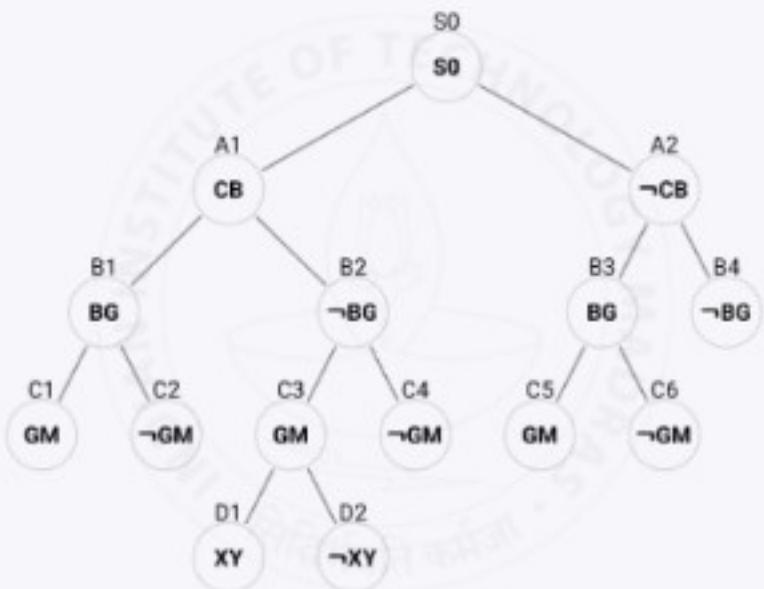
- BD
- BG
- BM
- CB
- CD
- CG
- CM
- DG
- DM
- GM

$$\sum = 5990$$

	Chennai	Goa	Mumbai	Delhi	Bangalore
Chennai	-	800	1280	2190	360
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Bangalore	360	570	1210	2434	-

	Chennai	Goa	Mumbai	Delhi	Bangalore
Chennai	-	800	1280	2190	360
Goa	800	-	590	2880	570
Mumbai	1280	590	-	1540	1210
Delhi	2190	2880	1540	-	2434
Bangalore	360	570	1210	2434	-

CB	BG	GM	CG	MB
360	570	590	800	1210
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$$XY = CG$$

$$b_2 = \{ \begin{matrix} CBM0G \\ CBM1G0 \\ CBDMG \\ BCM1G0 \end{matrix} \}$$

$$c_3 = \{ \begin{matrix} \cancel{CBM1G0} \\ CBM1G0 \\ CBDMG \\ BCM1G0 \end{matrix} \}$$

$$D_2 = \{ \begin{matrix} CBM0G \\ BCM1G0 \end{matrix} \}$$

5975

$$D_1 = \{ \begin{matrix} CBDMG \end{matrix} \}$$

5724