FINDING THE SHORTEST PATH BETWEEN ALL THE STATE CAPITAL CITIES OF INDIA

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ABSTRACT

In this paper methods of finding shortest path between the 27 capital cities in India using Graph theoretic algorithms namely kruskal's and prim's algorithms are discussed. The aim is to overcome longer distance that consumes more time and cost.

INTRODUCTION

Most problems in graph theory can be described under the following headings
- Existence Problems
- Construction Problems
- Enumeration Problems
- Optimization Problems

The present problem which deals with the method of finding shortest spanning tree for connecting all the capital cities of India is an optimization problem.

1. BASIC CONCEPTS

1.1. Weighted graph

A weighted graph has an order (V, E, F) where V is set of vertices and E is the set of edges. Here G is a function whose domain is E. A function F is an assignment of weights to the vertices and the functions G is an assignments of weights to the edges. The weight can be numbers, symbols etc.

2.2 Spanning Tree

A spanning tree of a graph is just a sub graph that contains all the vertices and is a tree. On a connected graph G = (V, E), a spanning tree (i) is a connected sub graph (ii) has no circuits (iii) is a tree ($|E| = |V| - 1$) (iv) contains all vertices of G

2.3 Minimum spanning tree: A minimum spanning tree in a connected weighted graph is a spanning tree that has the smallest possible sum of weights of its edges.

3. KRUSKAL'S ALGORITHM

1. It is an Algorithm in graph theory that finds a minimum spanning tree for a connected weighted graph
2. Kruskal is where we order the nodes from smallest to largest and pick accordingly.
3. Kruskal allows both new-new nodes and old-old nodes to get connected.
4. Kruskal's algorithm builds a minimum spanning tree by adding one edge at a time. The next line is always the shortest only if it does not create a cycle.
5. Kruskal's requires to sort the edge weights first.

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Steps for algorithm
1. Arrange all edges in a list (L) in non-decreasing order
2. Select edges from L, and include that in set T, avoid cycle.
3. Edge first. Repeat 3 until T becomes a tree that covers all vertices

3.1 Kruskal's algorithm in context to the problem

In this section we discuss applicability of algorithm to find out the shortest path between 27capital cities of India. The sorted list of distances from **one capital city to other capital city** of India in non decreasing order are given in Appendix I
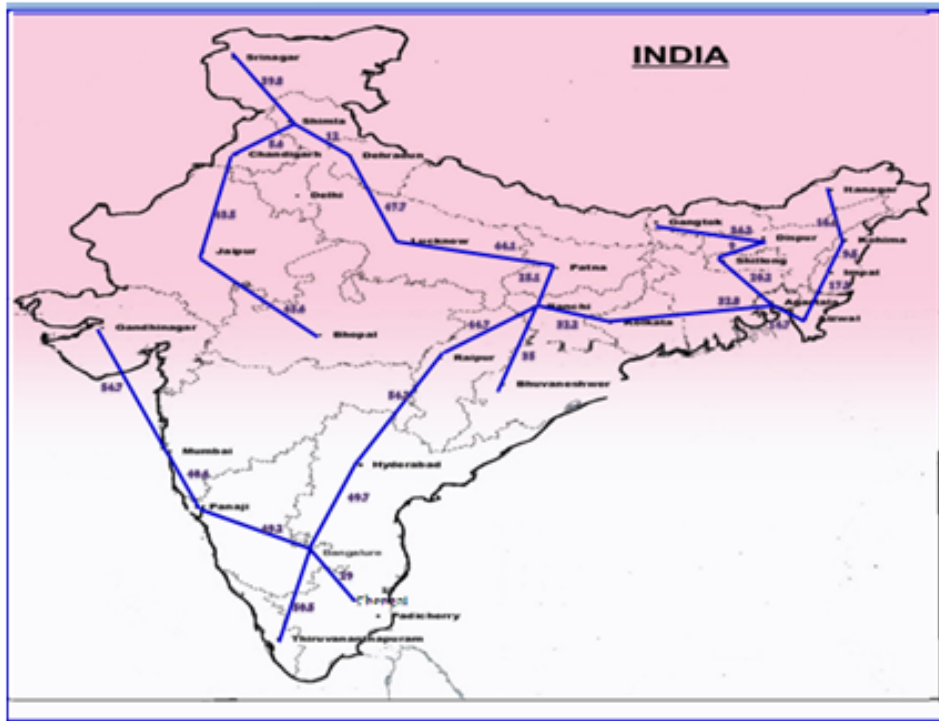
Shortest Path:

Shillong - Dispur -9	Gandhi nagar – Mumbai – 54.7	Lucknow – Patna - 44.1
Kohima - Imphal - 9.5	Mumbai - Patna – 40.6	Bhubaneswar – Ranchi – 35
Kohima - Itanagar – 16.6	Patna – Bangalore – 49.2	Ranchi – Kolkata – 32.2
Srinagar- Shimla – 39.8	Thiruvananthapuram – Bangalore - 50.5	Kolkata - Agartala – 32.8
Chandigarh – Shimla – 5.4	Bangalore – Chennai – 29	Agartala – Shillong – 20.2
Chandigarh – Jaipur – 43.5	Bangalore – Hyderabad – 49.7	Agartala – Aizwal – 14.7
Shimla – Dehradun -12	Hyderabad – Raipur – 54.2	Gangtok – Dispur – 34.2
Dehradun – Lucknow – 47.7	Raipur – Ranchi – 44.7	Impal – Aizwal – 17.3
Jaipur – Bhopal - 43.6		Ranchi – Patna – 25.1

The Shortest Distance is 862 Units
        1Unit=10km

4. PRIMS ALGORITHM

Prim's algorithm finds a minimum spanning tree for a connected weighted graph. It implies that it finds a subset of edges that form a tree where the total weight of all the edges in the tree is minimized. Steps for Algorithm:

1. Pick some arbitrary start node s. Initialize tree T = {s}.
2. Repeatedly add the shortest edge incident to T (the shortest edge having one vertex in T and one vertex not in T) until the tree spans all the nodes.

4.1: Applicability of prim's algorithm in context to the problem

The sorted list of distances from **one capital city to other capital cities** of India are given in Appendix II
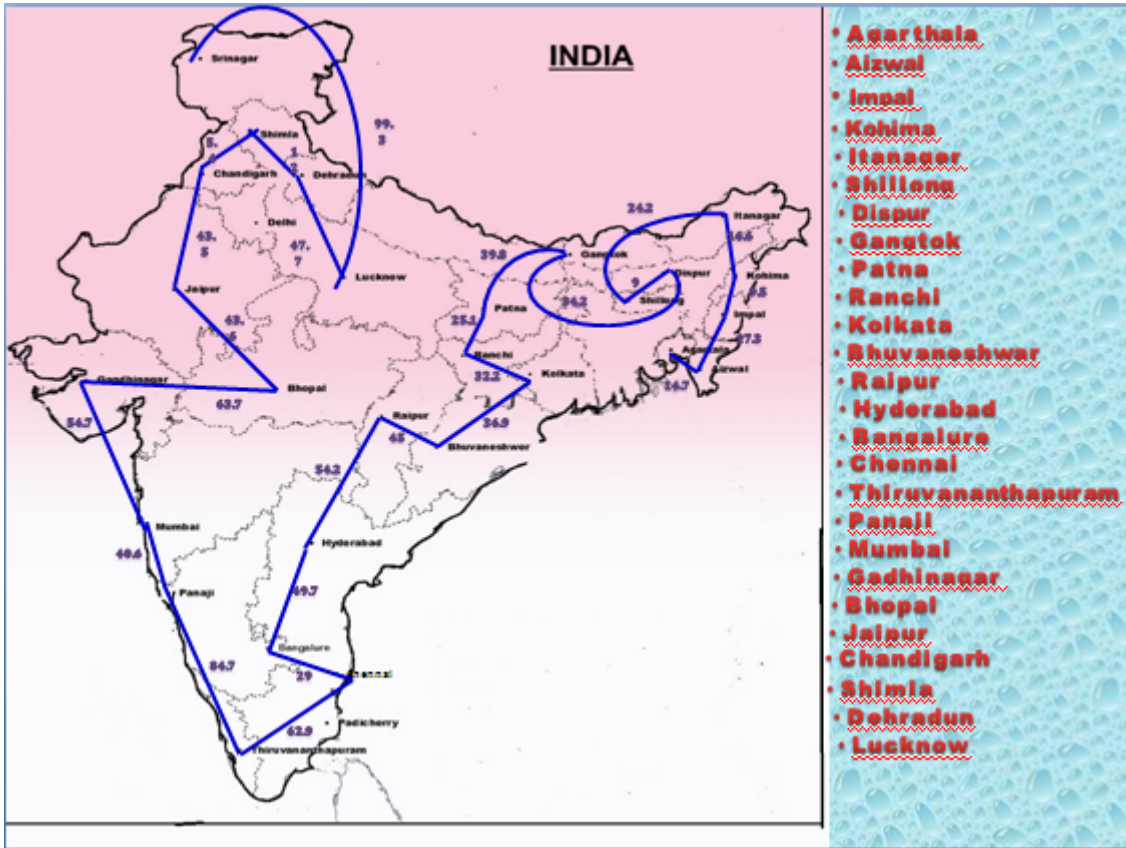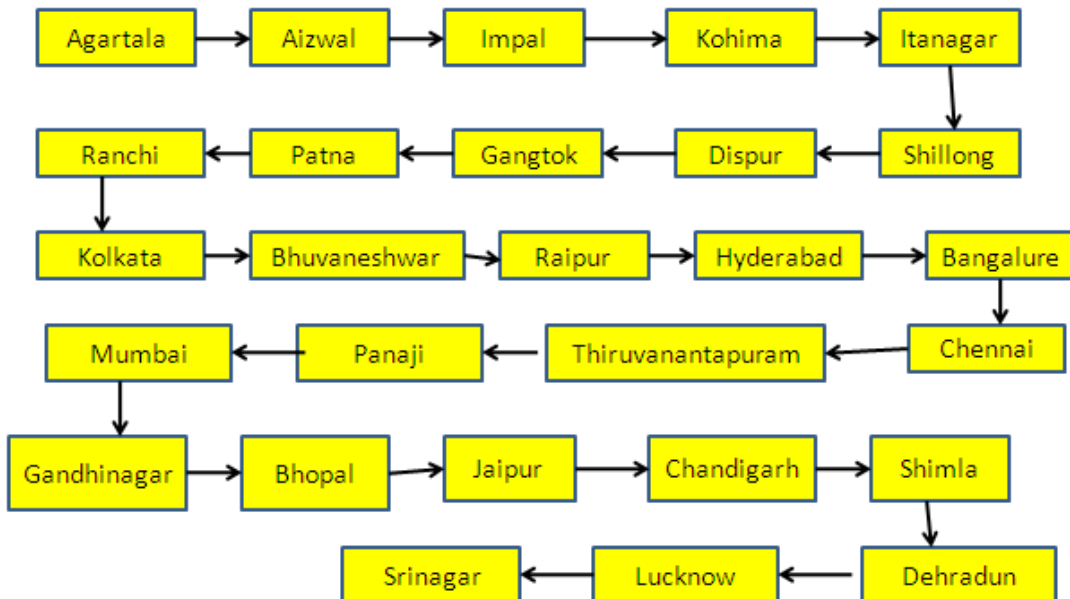
5. DIFFERENCE BETWEECE BETWEEN PRIM'S AND KRUSKAL'S ALGORITHMS IN CONNECTION TO THE PROBLEM

In Prim's algorithm edges of minimum weight that are incident on a vertex already in the tree that are not forming a circuit are chosen where as in kruskal's algorithm edges of minimum weight are not chosen.

In Prim's algorithm, if the edges are not ordered, there may be more than one choice for the edge to add at a stage of this procedure. Consequently, the edges need to be ordered for the procedure to be deterministic.

Prim's method starts with one vertex of a graph as your tree, and adds the smallest edge that grows your tree by one more vertex. Kruskal starts with all of the vertices of a graph as a forest, and adds the smallest edge that joins two trees in the forest.

Prim's method is better when
- You can only concentrate on one tree at a time
- You can concentrate on only a few edges at a time

Kruskal's method is better when
- You can look at all of the edges at once
- You can hold all of the vertices at once
- You can hold a forest, not just one tree

Kruskal's builds a minimum spanning tree by adding one **edge** at a time. The next line is always the shortest (minimum weight) ONLY if it does NOT create a cycle. Prim's builds a minimum spanning tree by adding one **vertex** at a time. The next vertex to be added is always the one nearest to a vertex already on the graph.

Prim always joins a "new" vertex to an "old" vertex, so that every stage is a tree. Kruskal's allows both "new" to "new" and "old" to "old" to get connected, so it risks creating a circuit and must check for them every time. So Kruskal's has a larger complexity than Prim's.
Prim's is easier to draw.

Aside from that, Prim's selects edges only from the set of edges that are adjacent to those you have already put in your tree. Kruskal's selects edges from the set of all possible edges.

6. RESULT

After completing the two types of graph algorithms, we found that the route (Agartala-Aizwal-Imphal-Kohima-Itanagar-Shillong-Dispur-Gangtok-Patna-Ranchi-Kolkata-Bhuvaneshwar-Raipur-Hyderabad-Bangalure-Chennai-Thiru-vananthapuram-Panaji-Mumbai-Ghandinagar-Bhopal-Jaipur-Chandigarh-Shimla-Dehradun-Lucknow-Srinagar)
obtained using Prim's was the route representing the shortest distance of 9956 kilometers. By using the application of graph theory, we are able to create the "cheapest" travel plan with the lowest cost and the "shortest" travel plan. The result from Kruskal's algorithm is same as the optimal solutions found by the primary procedures.

CONCLUSION

Graph theory is an effective method of creating routes for travel plan. The algorithmic graphs showed the optimal solution for the cost and distance for travel between the twenty seven cities.

Though Kruskal's algorithm gives the shortest distance (8620 km) between all the capital cities of India, we cannot find the exact route from this algorithm. But Prim's gives the exact route with minimum distance. Hence we can conclude that the prim's algorithm is most preferable for travel planning.

REFERENCE BOOKS

- C.Vasudev, *Applications in graph theory*, New age international
- Narsing deo ,*Graph theory*, PHI Learning Pvt Ltd.
- Edgar G.goodaire, Michael M.Parmente, *Discrete Mathematics with Graph theory,* Prentice Hall
- S.Pirzada, *An Introduction to Graph Theory*, University Press
- http/graphtheory

Note: Data in this paper includes 27 capital cities of India excluding new capital city, Amaravathi of Andhra Pradesh.

Data is collected from authentic source

APPENDIX I

1	Agarthala	Agarthala	0
2	Aizawl	Aizawl	0
3	Banglore	Banglore	0
4	Bhuvanehwar	Bhuvanehwar	0
5	Chandighar	Chandighar	0
6	Chennai	Chennai	0
7	Dehradun	Dehradun	0
8	Gangtok	Gangtok	0
9	Panaji	Panaji	0
10	Hyderabad	Hyderabad	0
11	Imphal	Imphal	0
12	Itanagar	Itanagar	0
13	Jaipur	Jaipur	0
14	Kohima	Kohima	0
15	Kolkota	Kolkota	0
16	Lucknow	Lucknow	0
17	Mumbai	Mumbai	0
18	Patna	Patna	0
19	Ranchi	Ranchi	0
20	Raipur	Raipur	0
21	Srinagar	Srinagar	0
22	Shimla	Shimla	0
23	Shilong	Shilong	0
24	Trivadrum	Trivadrum	0
25	Dispur	Dispur	0
26	Gandhinagar	Gandhinagar	0
27	Bhopal	Bhopal	0
28	Chandighar	Shimla	5.4
29	Shilong	Dispur	9
30	Imphal	Kohima	9.5
31	Kohima	Imphal	9.5
32	Dehradun	Shimla	12
33	Shimla	Dehradun	12
34	Chandighar	Dehradun	12.8
35	Dehradun	Chandighar	12.8
36	Agarthala	Aizawl	14.7
37	Aizawl	Agarthala	14.7
38	Itanagar	Kohima	16.6
39	Kohima	Itanagar	16.6
40	Aizawl	Imphal	17.3
41	Imphal	Aizawl	17.3
42	Agarthala	Shilong	20.2
43	Shilong	Agarthala	20.2
44	Imphal	Dispur	21.5
45	Dispur	Imphal	21.5

46	Aizawl	Shilong	22
47	Shilong	Aizawl	22
48	Imphal	Shilong	22.4
49	Kohima	Shilong	22.4
50	Shilong	Imphal	22.4
51	Shilong	Kohima	22.4
52	Itanagar	Shilong	24.2
53	Shilong	Itanagar	24.2
54	Gandhinagar	Aizawl	24.3
55	Patna	Ranchi	25.1
56	Ranchi	Patna	25.1
57	Imphal	Itanagar	25.6
58	Itanagar	Imphal	25.6
59	Aizawl	Kohima	25.7
60	Kohima	Aizawl	25.7
61	Banglore	Chennai	29
62	Chennai	Banglore	29
63	Agarthala	Imphal	29.2
64	Imphal	Agarthala	29.2
65	Agarthala	Dispur	31.1
66	Dispur	Agarthala	31.1
67	Kolkota	Ranchi	32.2
68	Ranchi	Kolkota	32.2
69	Itanagar	Dispur	32.7
70	Dispur	Itanagar	32.7
71	Agarthala	Kolkota	32.8
72	Kolkota	Agarthala	32.8
73	Gangtok	Dispur	34.2
74	Dispur	Gangtok	34.2
75	Bhuvanehwar	Ranchi	35
76	Ranchi	Bhuvanehwar	35
77	Agarthala	Kohima	35.1
78	Kohima	Agarthala	35.1
79	Bhuvanehwar	Kolkota	36.9
80	Kolkota	Bhuvanehwar	36.9
81	Gangtok	Shilong	37.9
82	Shilong	Gangtok	37.9
83	Aizawl	Itanagar	38.5
84	Itanagar	Aizawl	38.5
85	Gangtok	Patna	39.8
86	Patna	Gangtok	39.8
87	Srinagar	Shimla	39.8
88	Shimla	Srinagar	39.8
89	Panaji	Mumbai	40.6
90	Mumbai	Panaji	40.6
91	Chandighar	Srinagar	41.5
92	Srinagar	Chandighar	41.5

93	Agarthala	Itanagar	43.2
94	Itanagar	Agarthala	43.2
95	Chandighar	Jaipur	43.5
96	Dehradun	Jaipur	43.5
97	Jaipur	Chandigarh	43.5
98	Jaipur	Dehradun	43.5
99	Jaipur	Bhopal	43.6
100	Bhopal	Jaipur	43.6
101	Lucknow	Patna	44.1
102	Patna	Lucknow	44.1
103	Ranchi	Raipur	44.7
104	Raipur	Ranchi	44.7
105	Bhuvanehwar	Raipur	45
106	Raipur	Bhubaneshwar	45
107	Aizawl	Kolkota	46.2
108	Kolkota	Aizawl	46.2
109	Agarthala	Gangtok	47.1
110	Gangtok	Agarthala	47.1
111	Kolkota	Patna	47.1
112	Patna	Kolkota	47.1
113	Dehradun	Lucknow	47.7
114	Lucknow	Dehradun	47.7
115	Jaipur	Shimla	48.3
116	Shimla	Jaipur	48.3
117	Aizawl	Dispur	48.6
118	Kolkota	Shilong	48.8
119	Shilong	Kolkota	48.8
120	Dispur	Aizawl	48.8
121	Raipur	Bhopal	49
122	Bhopal	Raipur	49
123	Banglore	Panaji	49.2
124	Panaji	Banglore	49.2
125	Gangtok	Itanagar	49.5
126	Itanagar	Gangtok	49.5
127	Banglore	Hyderabad	49.7
128	Hyderabad	Banglore	49.7
129	Banglore	Trivadrum	50.5
130	Jaipur	Lucknow	50.5
131	Lucknow	Jaipur	50.5
132	Trivadrum	Banglore	50.5
133	Chennai	Hyderabad	51.4
134	Hyderabad	Chennai	51.4
135	Dehradun	Srinagar	51.6
136	Srinagar	Dehradun	51.6
137	Gangtok	Kolkota	53
138	Kolkota	Gangtok	53
139	Lucknow	Bhopal	53.3
140	Bhopal	Lucknow	53.3

141	Panaji	Hyderabad	53.7
142	Hyderabad	Panaji	53.7
143	Hyderabad	Raipur	54.2
144	Raipur	Hyderabad	54.2
145	Shimla	Chandigarh	54.2
146	Mumbai	Gandhinagar	54.7
147	Gandhinagar	Mumbai	54.7
148	Gangtok	Ranchi	55.2
149	Ranchi	Gangtok	55.2
150	Aizawl	Gangtok	57.3
151	Gangtok	Aizawl	57.3
152	Gangtok	Kohima	57.7
153	Kohima	Gangtok	57.7
154	Chandighar	Lucknow	59
155	Lucknow	Chandighar	59
156	Lucknow	Ranchi	59
157	Ranchi	Lucknow	59
158	Lucknow	Shimla	59.6
159	Shimla	Lucknow	59.6
160	Bhuvanehwar	Patna	60.1
161	Gangtok	Imphal	60.1
162	Imphal	Gangtok	60.1
163	Patna	Bhubaneshwar	60.1
164	Patna	Raipur	60.1
165	Raipur	Patna	60.1
166	Agarthala	Ranchi	60.7
167	Ranchi	Agarthala	60.7
168	Imphal	Kolkota	62
169	Kolkota	Imphal	62
170	Hyderabad	Mumbai	62.1
171	Mumbai	Hyderabad	62.1
172	Lucknow	Raipur	62.8
173	Raipur	Lucknow	62.8
174	Chennai	Trivadrum	62.9
175	Trivadrum	Chennai	62.9
176	Gandhinagar	Bhopal	63.7
177	Bhopal	Gandhinagar	63.7
178	Jaipur	Gandhinagar	65
179	Gandhinagar	Jaipur	65
180	Agarthala	Patna	65.2
181	Patna	Agarthala	65.2
182	Hyderabad	Bhopal	66.4
183	Bhopal	Hyderabad	66.4
184	Mumbai	Bhopal	66.8
185	Bhopal	Mumbai	66.8
186	Patna	Dispur	67
187	Dispur	Patna	67
188	Kohima	Kolkota	67.7

189	Kolkota	Kohima	67.7
190	Patna	Shilong	67.8
191	Shilong	Patna	67.8
192	Agarthala	Bhuvanehwar	68.9
193	Bhuvanehwar	Agarthala	68.9
194	Kohima	Dispur	69
195	Dispur	Kohima	69
196	Ranchi	Shillong	70.7
197	Shilong	Ranchi	70.7
198	Kolkota	Raipur	71
199	Raipur	Kolkota	71
200	Ranchi	Dispur	72.3
201	Dispur	Ranchi	72.3
202	Itanagar	Kolkota	73
203	Kolkota	Itanagar	73
204	Chennai	Panaji	74.3
205	Panaji	Chennai	74.3
206	Aizawl	Ranchi	75.3
207	Ranchi	Aizawl	75.3
208	Gangtok	Lucknow	76.3
209	Lucknow	Gangtok	76.3
210	Dehradun	Bhopal	78.6
211	Bhopal	Dehradun	78.6
212	Aizawl	Patna	79.5
213	Patna	Aizawl	79.5
214	Jaipur	Srinagar	80.2
215	Srinagar	Jaipur	80.2
216	Aizawl	Bhuvanehwar	80.9
217	Bhuvanehwar	Aizawl	80.9
218	Ranchi	Bhopal	81
219	Bhopal	Ranchi	81
220	Patna	Bhopal	82.2
221	Bhopal	Patna	82.2
222	Chandighar	Bhopal	83.2
223	Bhopal	Chandighar	83.2
224	Bhuvanehwar	Hyderabad	83.7
225	Hyderabad	Bhuvanehwar	83.7
226	Bhuvanehwar	Gangtok	83.8
227	Gangtok	Bhuvanehwar	83.8
228	Banglore	Mumbai	84.1
229	Mumbai	Banglore	84.1
230	Panaji	Trivadrum	84.7
231	Trivadrum	Panaji	84.7
232	Bhuvanehwar	Shilong	85.7
233	Shilong	Bhuvanehwar	85.7
234	Itanagar	Patna	86.2
235	Patna	Itanagar	86.2
236	Jaipur	Raipur	86.4

237	Raipur	Jaipur	86.4
238	Dehradun	Patna	87
239	Patna	Dehradun	87
240	Shimla	Bhopal	87.1
241	Bhopal	Shimla	87.1
242	Bhuvanehwar	Lucknow	88.9
243	Imphal	Ranchi	88.9
244	Lucknow	Bhuvanehwar	88.9
245	Ranchi	Imphal	88.9
246	Kolkota	Lucknow	89
247	Lucknow	Kolkota	89
248	Hyderabad	Gandhinagar	89.1
249	Gandhinagar	Hyderabad	89.1
250	Bhuvanehwar	Dispur	89.2
251	Imphal	Patna	89.2
252	Patna	Imphal	89.2
253	Dispur	Bhuvanehwar	89.3
254	Kohima	Patna	90.2
255	Patna	Kohima	90.2
256	Chennai	Raipur	91.7
257	Raipur	Chennai	91.7
258	Kohima	Ranchi	92.4
259	Ranchi	Kohima	92.4
260	Lucknow	Gandhinagar	92.8
261	Gandhinagar	Lucknow	92.8
262	Jaipur	Mumbai	92.9
263	Mumbai	Jaipur	92.9
264	Chandighar	Gandhinagar	93
265	Gandhinagar	Chandighar	93
266	Itanagar	Ranchi	93.1
267	Ranchi	Itanagar	93.1
268	Bhuvanehwar	Bhopal	93.3
269	Bhopal	Bhuvanehwar	93.3
270	Jaipur	Patna	93.8
271	Patna	Jaipur	93.8
272	Panaji	Bhopal	94.2
273	Bhopal	Panaji	94.2
274	Mumbai	Raipur	94.9
275	Raipur	Mumbai	94.9
276	Hyderabad	Ranchi	97.5
277	Ranchi	Hyderabad	97.5
278	Bhuvanehwar	Imphal	97.6
279	Imphal	Bhubaneshwar	97.6
280	Gangtok	Raipur	97.9
281	Raipur	Gangtok	97.9
282	Shimla	Gandhinagar	98.3
283	Gandhinagar	Shimla	98.3
284	Patna	Shimla	98.8

285	Shimla	Patna	98.8
286	Bhuvanehwar	Chennai	99
287	Chennai	Bhuvanehwar	99
288	Lucknow	Srinagar	99.3
289	Srinagar	Lucknow	99.3
290	Chandighar	Patna	99.5
291	Patna	Chandigarh	99.5
292	Hyderabad	Trivadrum	100.2
293	Trivadrum	Hyderabad	100.2
294	Banglore	Raipur	101.2
295	Raipur	Banglore	101.2
296	Agarthala	Raipur	103.1
297	Chennai	Mumbai	103.1
298	Mumbai	Chennai	103.1
299	Raipur	Agarthala	103.1
300	Jaipur	Ranchi	103.6
301	Ranchi	Jaipur	103.6
302	Bhuvanehwar	Kohima	104
303	Kohima	Bhuvanehwar	104
304	Panaji	Raipur	104.1
305	Raipur	Panaji	104.1
306	Kolkota	Dispur	104.2
307	Dispur	Kolkota	104.2
308	Dehradun	Ranchi	105.9
309	Ranchi	Dehradun	105.9
310	Dehradun	Raipur	107.2
311	Raipur	Dehradun	107.2
312	Dehradun	Gangtok	108.2
313	Gangtok	Dehradun	108.2
314	Hyderabad	Lucknow	108.3
315	Lucknow	Hyderabad	108.3
316	Lucknow	Dispur	108.9
317	Dispur	Lucknow	108.9
318	Agarthala	Lucknow	109.3
319	Lucknow	Agarthala	109.3
320	Hyderabad	Jaipur	109.5
321	Jaipur	Hyderabad	109.5
322	Bhuvanehwar	Itanagar	109.9
323	Itanagar	Bhubaneshwar	109.9
324	Lucknow	Shilong	110.2
325	Shilong	Lucknow	110.2
326	Panaji	Gandhinagar	110.6
327	Gandhinagar	Panaji	110.6
328	Kolkota	Bhopal	112.5
329	Bhopal	Kolkota	112.5
330	Hyderabad	Patna	114.3
331	Patna	Hyderabad	114.3
332	Banglore	Bhopal	114.4

333	Bhopal	Banglore	114.4
334	Raipur	Shillong	115.1
335	Shilong	Raipur	115.1
336	Dehradun	Gandhinagar	115.5
337	Gandhinagar	Dehradun	115.5
338	Chandighar	Raipur	116.2
339	Raipur	Chandigarh	116.2
340	Aizawl	Raipur	117.1
341	Chennai	Bhopal	117.1
342	Raipur	Aizawl	117.1
343	Bhopal	Chennai	117.1
344	Chandighar	Ranchi	117.8
345	Ranchi	Chandighar	117.8
346	Ranchi	Shimla	118
347	Shimla	Ranchi	118
348	Hyderabad	Kolkota	118.3
349	Kolkota	Hyderabad	118.3
350	Raipur	Shimla	118.3
351	Shimla	Raipur	118.3
352	Gangtok	Shimla	118.6
353	Shimla	Gangtok	118.6
354	Banglore	Bhuvanehwar	119.1
355	Bhuvanehwar	Banglore	119.1
356	Lucknow	Mumbai	119.9
357	Mumbai	Lucknow	119.9
358	Raipur	Gandhinagar	120.5
359	Gandhinagar	Raipur	120.5
360	Chandighar	Gangtok	120.9
361	Gangtok	Chandighar	120.9
362	Gangtok	Bhopal	121.4
363	Bhopal	Gangtok	121.4
364	Srinagar	Bhopal	122.8
365	Bhopal	Srinagar	122.8
366	Aizawl	Lucknow	123.5
367	Lucknow	Aizawl	123.5
368	Mumbai	Trivadrum	125
369	Trivadrum	Mumbai	125
370	Banglore	Gandhinagar	125.5
371	Gandhinagar	Banglore	125.5
372	Itanagar	Lucknow	125.8
373	Lucknow	Itanagar	125.8
374	Chennai	Ranchi	125.9
375	Ranchi	Chennai	125.9
376	Bhuvanehwar	Jaipur	126.1
377	Jaipur	Bhubaneshwar	126.1
378	Gangtok	Jaipur	126.6
379	Jaipur	Gangtok	126.6
380	Panaji	Jaipur	128.7

381	Jaipur	Panaji	128.7
382	Imphal	Raipur	132.1
383	Raipur	Imphal	132.1
384	Kohima	Lucknow	132.2
385	Lucknow	Kohima	132.2
386	Imphal	Lucknow	132.3
387	Lucknow	Imphal	132.3
388	Dehradun	Kolkota	134
389	Kolkota	Dehradun	134
390	Jaipur	Kolkota	135.5
391	Kolkota	Jaipur	135.5
392	Chennai	Kolkota	135.7
393	Kolkota	Chennai	135.7
394	Dehradun	Mumbai	136.1
395	Mumbai	Dehradun	136.1
396	Raipur	Dispur	136.1
397	Dispur	Raipur	136.1
398	Chandighar	Mumbai	136.2
399	Mumbai	Chandigarh	136.2
400	Kohima	Raipur	136.4
401	Raipur	Kohima	136.4
402	Bhuvanehwar	Mumbai	136.6
403	Mumbai	Bhubaneshwar	136.6
404	Bhuvanehwar	Dehradun	136.7
405	Dehradun	Bhuvanehwar	136.7
406	Patna	Srinagar	136.8
407	Srinagar	Patna	136.8
408	Bhuvanehwar	Panaji	137.4
409	Panaji	Bhuvanehwar	137.4
410	Itanagar	Raipur	137.8
411	Raipur	Itanagar	137.8
412	Mumbai	Ranchi	138
413	Ranchi	Mumbai	138
414	Banglore	Ranchi	141.2
415	Mumbai	Shimla	141.2
416	Ranchi	Banglore	141.2
417	Shimla	Mumbai	141.2
418	Agarthala	Bhopal	141.5
419	Bhopal	Agarthala	141.5
420	Dehradun	Dispur	142.6
421	Dispur	Dehradun	142.6
422	Dehradun	Hyderabad	143.9
423	Hyderabad	Dehradun	143.9
424	Dehradun	Shilong	145.7
425	Mumbai	Patna	145.7
426	Patna	Mumbai	145.7
427	Shilong	Dehradun	145.7
428	Kolkota	Shimla	145.9

429	Shimla	Kolkota	145.9
430	Panaji	Lucknow	146
431	Lucknow	Panaji	146
432	Chandighar	Kolkota	146.4
433	Kolkota	Chandighar	146.4
434	Bhuvanehwar	Chandighar	147.7
435	Chandighar	Bhuvanehwar	147.7
436	Chennai	Patna	148
437	Patna	Chennai	148
438	Bhuvanehwar	Shimla	148.6
439	Shimla	Bhubaneshwar	148.6
440	Shilong	Bhopal	148.7
441	Bhopal	Shilong	148.7
442	Panaji	Ranchi	148.8
443	Ranchi	Panaji	148.8
444	Dispur	Bhopal	148.9
445	Bhopal	Dispur	148.9
446	Agarthala	Dehradun	149.4
447	Dehradun	Agarthala	149.4
448	Chandighar	Hyderabad	149.5
449	Hyderabad	Chandighar	149.5
450	Raipur	Trivadrum	150.5
451	Shimla	Dispur	150.5
452	Trivadrum	Raipur	150.5
453	Dispur	Shimla	150.5
454	Dispur	Shilong	150.5
455	Agarthala	Hyderabad	151.2
456	Hyderabad	Agarthala	151.2
457	Gangtok	Srinagar	151.5
458	Srinagar	Gangtok	151.5
459	Gangtok	Hyderabad	151.9
460	Hyderabad	Gangtok	151.9
461	Chennai	Lucknow	153.1
462	Hyderabad	Shimla	153.1
463	Lucknow	Chennai	153.1
464	Shimla	Hyderabad	153.1
465	Chandighar	Dispur	155.4
466	Dispur	Chandighar	155.4
467	Banglore	Kolkota	155.9
468	Dehradun	Itanagar	155.9
469	Itanagar	Dehradun	155.9
470	Kolkota	Banglore	155.9
471	Aizawl	Bhopal	156.1
472	Banglore	Jaipur	156.1
473	Jaipur	Banglore	156.1
474	Bhopal	Aizawl	156.1
475	Shimla	Shilong	156.4
476	Shilong	Shimla	156.4

477	Ranchi	Srinagar	157.1
478	Srinagar	Ranchi	157.1
479	Raipur	Srinagar	157.7
480	Srinagar	Raipur	157.7
481	Banglore	Lucknow	158
482	Lucknow	Banglore	158
483	Chandighar	Shilong	158.5
484	Shilong	Chandighar	158.5
485	Agarthala	Jaipur	158.9
486	Jaipur	Agarthala	158.9
487	Chennai	Jaipur	160.6
488	Jaipur	Chennai	160.6
489	Agarthala	Shimla	160.7
490	Patna	Gandhinagar	160.7
491	Shimla	Agarthala	160.7
492	Gandhinagar	Patna	160.7
493	Banglore	Patna	160.8
494	Jaipur	Shilong	160.8
495	Patna	Banglore	160.8
496	Shilong	Jaipur	160.8
497	Kolkota	Gandhinagar	161.2
498	Gandhinagar	Kolkota	161.2
499	Bhuvanehwar	Trivadrum	162
500	Trivadrum	Bhuvanehwar	162
501	Agarthala	Chandighar	162.2
502	Chandighar	Agarthala	162.2
503	Panaji	Patna	162.4
504	Patna	Panaji	162.4
505	Aizawl	Dehradun	162.6
506	Dehradun	Aizawl	162.6
507	Aizawl	Hyderabad	164.1
508	Hyderabad	Aizawl	164.1
509	Trivadrum	Bhopal	164.4
510	Bhopal	Trivadrum	164.4
511	Itanagar	Shimla	165.7
512	Shimla	Itanagar	165.7
513	Hyderabad	Shilong	165.8
514	Shilong	Hyderabad	165.8
515	Dehradun	Kohima	165.9
516	Kohima	Dehradun	165.9
517	Kolkota	Mumbai	166
518	Mumbai	Kolkota	166
519	Agarthala	Chennai	166.3
520	Chennai	Agarthala	166.3
521	Srinagar	Gandhinagar	166.8
522	Gandhinagar	Srinagar	166.8
523	Dehradun	Imphal	168.1
524	Imphal	Dehradun	168.1

525	Hyderabad	Dispur	168.3
526	Dispur	Hyderabad	168.3
527	Chandighar	Itanagar	168.5
528	Itanagar	Chandigarh	168.5
529	Itanagar	Bhopal	168.5
530	Bhopal	Itanagar	168.5
531	Mumbai	Srinagar	168.6
532	Srinagar	Mumbai	168.6
533	Imphal	Bhopal	168.8
534	Bhopal	Imphal	168.8
535	Trivadrum	Gandhinagar	170.3
536	Gandhinagar	Trivadrum	170.3
537	Dehradun	Panaji	170.4
538	Panaji	Dehradun	170.4
539	Kohima	Bhopal	171.1
540	Bhopal	Kohima	171.1
541	Panaji	Kolkota	171.7
542	Kolkota	Panaji	171.7
543	Chandighar	Panaji	172.2
544	Panaji	Chandighar	172.2
545	Aizawl	Jaipur	173.3
546	Jaipur	Aizawl	173.3
547	Aizawl	Shimla	173.7
548	Shimla	Aizawl	173.7
549	Ranchi	Gandhinagar	175.2
550	Gandhinagar	Ranchi	175.2
551	Aizawl	Chandighar	175.4
552	Chandighar	Aizawl	175.4
553	Itanagar	Jaipur	176.1
554	Jaipur	Itanagar	176.1
555	Kohima	Shimla	176.2
556	Shimla	Kohima	176.2
557	Aizawl	Chennai	176.5
558	Chennai	Aizawl	176.5
559	Panaji	Shimla	176.9
560	Shimla	Panaji	176.9
561	Bhuvanehwar	Gandhinagar	177.6
562	Gandhinagar	Bhuvanehwar	177.6
563	Chennai	Gandhinagar	177.7
564	Gandhinagar	Chennai	177.7
565	Chandighar	Kohima	178.6
566	Kohima	Chandighar	178.6
567	Imphal	Shimla	178.7
568	Shimla	Imphal	178.7
569	Hyderabad	Imphal	180.4
570	Imphal	Hyderabad	180.4
571	Chennai	Gangtok	180.5
572	Gangtok	Chennai	180.5

573	Chandighar	Imphal	180.9
574	Imphal	Chandigarh	180.9
575	Imphal	Jaipur	182.7
576	Jaipur	Imphal	182.7
577	Jaipur	Kohima	182.7
578	Kohima	Jaipur	182.7
579	Kolkota	Srinagar	183.9
580	Srinagar	Kolkota	183.9
581	Chennai	Shilong	184.3
582	Shilong	Chennai	184.3
583	Gangtok	Mumbai	185.5
584	Mumbai	Gangtok	185.5
585	Srinagar	Dispur	185.5
586	Dispur	Srinagar	185.5
587	Hyderabad	Kohima	185.9
588	Kohima	Hyderabad	185.9
589	Agarthala	Banglore	187.8
590	Banglore	Agarthala	187.8
591	Ranchi	Trivadrum	188
592	Trivadrum	Ranchi	188
593	Bhuvanehwar	Srinagar	188.3
594	Srinagar	Bhuvanehwar	188.3
595	Chennai	Dispur	189.1
596	Dispur	Chennai	189.1
597	Hyderabad	Itanagar	189.3
598	Hyderabad	Srinagar	189.3
599	Itanagar	Hyderabad	189.3
600	Srinagar	Hyderabad	189.3
601	Srinagar	Shilong	189.5
602	Shilong	Srinagar	189.5
603	Agarthala	Gandhinagar	191.3
604	Gandhinagar	Agarthala	191.3
605	Banglore	Dehradun	192.8
606	Dehradun	Banglore	192.8
607	Chennai	Dehradun	192.9
608	Dehradun	Chennai	192.9
609	Chennai	Imphal	193.8
610	Imphal	Chennai	193.8
611	Itanagar	Srinagar	195.5
612	Srinagar	Itanagar	195.5
613	Jaipur	Dispur	195.9
614	Dispur	Jaipur	195.9
615	Agarthala	Srinagar	196
616	Srinagar	Agarthala	196
617	Banglore	Gangtok	196.4
618	Gangtok	Banglore	196.4
619	Banglore	Chandighar	197.6
620	Chandighar	Banglore	197.6

621	Agarthala	Mumbai	197.9
622	Mumbai	Agarthala	197.9
623	Kolkota	Trivadrum	198.7
624	Trivadrum	Kolkota	198.7
625	Aizawl	Banglore	199
626	Banglore	Aizawl	199
627	Chandighar	Chennai	199.4
628	Chennai	Chandighar	199.4
629	Chennai	Kohima	201.2
630	Kohima	Chennai	201.2
631	Banglore	Shimla	201.5
632	Gangtok	Panaji	201.5
633	Panaji	Gangtok	201.5
634	Shimla	Banglore	201.5
635	Chennai	Shimla	202.7
636	Shimla	Chennai	202.7
637	Aizawl	Gandhinagar	204.3
638	Agarthala	Panaji	204.6
639	Panaji	Agarthala	204.6
640	Banglore	Shilong	204.7
641	Shilong	Banglore	204.7
642	Jaipur	Trivadrum	205.2
643	Trivadrum	Jaipur	205.2
644	Panaji	Srinagar	207
645	Srinagar	Panaji	207
646	Kohima	Srinagar	207.7
647	Srinagar	Kohima	207.7
648	Aizawl	Srinagar	208.2
649	Srinagar	Aizawl	208.2
650	Lucknow	Trivadrum	208.5
651	Trivadrum	Lucknow	208.5
652	Banglore	Dispur	208.6
653	Chennai	Itanagar	208.6
654	Itanagar	Chennai	208.6
655	Mumbai	Shilong	208.6
656	Shilong	Mumbai	208.6
657	Dispur	Banglore	208.6
658	Patna	Trivadrum	209.1
659	Trivadrum	Patna	209.1
660	Mumbai	Dispur	210.5
661	Dispur	Mumbai	210.5
662	Imphal	Srinagar	211.4
663	Srinagar	Imphal	211.4
664	Aizawl	Mumbai	212
665	Mumbai	Aizawl	212
666	Itanagar	Gandhinagar	215.2
667	Gandhinagar	Itanagar	215.2
668	Banglore	Imphal	216.1

669	Imphal	Banglore	216.1
670	Aizawl	Panaji	217.7
671	Panaji	Aizawl	217.7
672	Panaji	Shilong	218.4
673	Shilong	Panaji	218.4
674	Gangtok	Gandhinagar	219.6
675	Gandhinagar	Gangtok	219.6
676	Kohima	Gandhinagar	220.7
677	Gandhinagar	Kohima	220.7
678	Panaji	Dispur	220.9
679	Dispur	Panaji	220.9
680	Banglore	Kohima	223
681	Kohima	Banglore	223
682	Imphal	Mumbai	226.7
683	Mumbai	Imphal	226.7
684	Banglore	Itanagar	228.9
685	Itanagar	Banglore	228.9
686	Agarthala	Trivadrum	229
687	Trivadrum	Agarthala	229
688	Itanagar	Mumbai	230.2
689	Mumbai	Itanagar	230.2
690	Kohima	Mumbai	230.5
691	Mumbai	Kohima	230.5
692	Panaji	Imphal	233.8
693	Imphal	Panaji	233.8
694	Banglore	Srinagar	236.3
695	Srinagar	Banglore	236.3
696	Aizawl	Trivadrum	238.7
697	Trivadrum	Aizawl	238.7
698	Panaji	Kohima	239.1
699	Kohima	Panaji	239.1
700	Chennai	Srinagar	239.8
701	Srinagar	Chennai	239.8
702	Panaji	Itanagar	241.7
703	Itanagar	Panaji	241.7
704	Dehradun	Trivadrum	243
705	Gangtok	Trivadrum	243
706	Trivadrum	Dehradun	243
707	Trivadrum	Gangtok	243
708	Shilong	Trivadrum	247.2
709	Trivadrum	Shilong	247.2
710	Chandighar	Trivadrum	247.4
711	Trivadrum	Chandighar	247.4
712	Trivadrum	Dispur	251.3
713	Dispur	Trivadrum	251.3
714	Shimla	Trivadrum	251.4
715	Trivadrum	Shimla	251.4
716	Dispur	Gandhinagar	252.3

717	Gandhinagar	Dispur	252.3
718	Imphal	Trivadrum	256.1
719	Trivadrum	Imphal	256.1
720	Shilong	Gandhinagar	258.8
721	Gandhinagar	Shilong	258.8
722	Kohima	Trivadrum	263.7
723	Trivadrum	Kohima	263.7
724	Itanagar	Trivadrum	271.5
725	Trivadrum	Itanagar	271.5
726	Srinagar	Trivadrum	285.4
727	Trivadrum	Srinagar	285.4
728	Imphal	Gandhinagar	299.9
729	Gandhinagar	Imphal	299.9

APPENDIX II

AGARTHALA			AIZAWL			BANGLORE	
Agarthala	0		Agarthala	14.7		Agarthala	187.8
Aizawl	14.7		Aizawl	0		Aizawl	199
Banglore	187.8		Banglore	199		Banglore	0
Bhuvaneshwar	68.9		Bhuvaneshwar	80.9		Bhuvaneshwar	119.1
Chandighar	162.2		Chandighar	175.4		Chandighar	197.6
Chennai	166.3		Chennai	176.5		Chennai	29
Dehradun	149.4		Dehradun	162.6		Dehradun	192.8
Gangtok	47.1		Gangtok	57.3		Gangtok	196.4
Panaji	204.6		Panaji	217.7		Panaji	49.2
Hyderabad	151.2		Hyderabad	164.1		Hyderabad	49.7
Imphal	29.2		Imphal	117.3		Imphal	216.1
Itanagar	43.2		Itanagar	38.5		Itanagar	228.9
Jaipur	158.9		Jaipur	173.3		Jaipur	156.1
Kohima	35.1		Kohima	25.7		Kohima	223
Kolkota	32.8		Kolkota	46.2		Kolkota	155.9
Lucknow	109.3		Lucknow	123.5		Lucknow	158
Mumbai	197.9		Mumbai	212		Mumbai	84.1
Patna	65.2		Patna	79.5		Patna	160.8
Ranchi	60.7		Ranchi	75.3		Ranchi	141.2
Raipur	103.1		Raipur	117.1		Raipur	101.2
Srinagar	196		Srinagar	208.2		Srinagar	236.3
Shimla	160.7		Shimla	173.7		Shimla	201.5
Shillong	20.2		Shillong	22		Shillong	204.7
Trivadrum	229		Trivadrum	238.7		Trivadrum	50.5
Dispur	31.1		Dispur	48.6		Dispur	208.6
Gandhinagar	191.3		Gandhinagar	204.3		Gandhinagar	125.5
Bhopal	141.5		Bhopal	156.1		Bhopal	114.4

BHUVANESHWAR			CHANDIGARH			CHENNAI	
Agarthala	68.9		Agarthala	162.2		Agarthala	166.3
Aizawl	80.9		Aizawl	175.4		Aizawl	176.5
Banglore	119.1		Banglore	197.6		Banglore	29
Bhuvaneshwar	0		Bhuvaneshwar	147.7		Bhuvaneshwar	99
Chandighar	147.7		Chandighar	0		Chandighar	199.4
Chennai	99		Chennai	199.4		Chennai	0
Dehradun	136.7		Dehradun	12.8		Dehradun	192.9
Gangtok	83.8		Gangtok	120.9		Gangtok	180.5
Panaji	137.4		Panaji	172.2		Panaji	74.3
Hyderabad	83.7		Hyderabad	149.5		Hyderabad	51.4
Imphal	97.6		Imphal	180.9		Imphal	193.8
Itanagar	109.9		Itanagar	168.5		Itanagar	208.6
Jaipur	126.1		Jaipur	43.5		Jaipur	160.6
Kohima	104		Kohima	178.6		Kohima	201.2
Kolkota	36.9		Kolkota	146.4		Kolkota	135.7
Lucknow	88.9		Lucknow	59		Lucknow	153.1
Mumbai	136.6		Mumbai	136.2		Mumbai	103.1
Patna	60.1		Patna	99.5		Patna	148
Ranchi	35		Ranchi	117.8		Ranchi	125.9
Raipur	45		Raipur	116.2		Raipur	91.7
Srinagar	188.3		Srinagar	41.5		Srinagar	239.8
Shimla	148.6		Shimla	5.4		Shimla	202.7
Shillong	85.7		Shillong	158.5		Shillong	184.3
Trivadrum	162		Trivadrum	247.4		Trivadrum	62.9
Dispur	89.2		Dispur	155.4		Dispur	189.1
Gandhinagar	177.6		Gandhinagar	93		Gandhinagar	177.7
Bhopal	93.3		Bhopal	83.2		Bhopal	117.1

DEHRADUN			GANGTOK			PANAJI	
Agarthala	149.4		Agarthala	47.1		Agarthala	204.6
Aizawl	162.6		Aizawl	57.3		Aizawl	217.7
Banglore	192.8		Banglore	196.4		Banglore	49.2
Bhuvaneshwar	136.7		Bhuvaneshwar	83.8		Bhuvaneshwar	137.4
Chandighar	12.8		Chandighar	120.9		Chandighar	172.2
Chennai	192.9		Chennai	180.5		Chennai	74.3
Dehradun	0		Dehradun	108.2		Dehradun	170.4
Gangtok	108.2		Gangtok	0		Gangtok	201.5
Panaji	170.4		Panaji	201.5		Panaji	0
Hyderabad	143.9		Hyderabad	151.9		Hyderabad	53.7
Imphal	155.9		Imphal	60.1		Imphal	233.8
Itanagar	155.9		Itanagar	49.5		Itanagar	241.7
Jaipur	43.5		Jaipur	126.6		Jaipur	128.7
Kohima	165.9		Kohima	57.7		Kohima	239.1
Kolkota	134		Kolkota	53		Kolkota	171.7
Lucknow	47.7		Lucknow	76.3		Lucknow	146

Mumbai	136.1		Mumbai	185.5		Mumbai	40.6
Patna	87		Patna	39.8		Patna	162.4
Ranchi	105.9		Ranchi	55.2		Ranchi	148.8
Raipur	107.2		Raipur	97.9		Raipur	104.4
Srinagar	51.6		Srinagar	151.5		Srinagar	207
Shimla	12		Shimla	118.6		Shimla	176.9
Shillong	145.7		Shillong	37.9		Shillong	218.4
Trivadrum	243		Trivadrum	243		Trivadrum	84.7
Dispur	142.6		Dispur	34.2		Dispur	220.9
Gandhinagar	115.5		Gandhinagar	219.6		Gandhinagar	110.6
Bhopal	78.6		Bhopal	121.4		Bhopal	94.2

HYDERABAD			**IMPHAL**			**ITANAGAR**	
Agarthala	51.2		Agarthala	29.2		Agarthala	43.2
Aizawl	164.1		Aizawl	17.3		Aizawl	38.5
Banglore	52.2		Banglore	216.1		Banglore	228.9
Bhuvaneshwar	83.7		Bhuvaneshwar	97.6		Bhuvaneshwar	109.9
Chandighar	149.5		Chandighar	180.9		Chandighar	216
Chennai	51.4		Chennai	193.8		Chennai	208.6
Dehradun	89.5		Dehradun	168.1		Dehradun	155.9
Gangtok	151.9		Gangtok	60.1		Gangtok	49.5
Panaji	53.7		Panaji	233.8		Panaji	241.7
Hyderabad	0		Hyderabad	180.4		Hyderabad	189.3
Imphal	180.4		Imphal	0		Imphal	25.6
Itanagar	189.3		Itanagar	25.6		Itanagar	0
Jaipur	109.5		Jaipur	182.7		Jaipur	176.1
Kohima	185.9		Kohima	9.5		Kohima	16.6
Kolkota	118.3		Kolkota	62		Kolkota	73
Lucknow	108.3		Lucknow	132.3		Lucknow	125.8
Mumbai	62.1		Mumbai	226.7		Mumbai	230.2
Patna	114.3		Patna	89.2		Patna	86.2
Ranchi	97.5		Ranchi	88.9		Ranchi	93.1
Raipur	54.2		Raipur	132.1		Raipur	137.8
Srinagar	189.3		Srinagar	211.4		Srinagar	195.5
Shimla	153.1		Shimla	178.7		Shimla	165.7
Shillong	180.4		Shillong	22.4		Shillong	24.2
Trivadrum	129.6		Trivadrum	256.1		Trivadrum	271.5
Dispur	168.3		Dispur	21.5		Dispur	32.7
Gandhinagar	89.1		Gandhinagar	299.9		Gandhinagar	215.2
Bhopal	66.4		Bhopal	168.8		Bhopal	168.5

JAIPUR		KOHIMA		KOLKOTA	
Agarthala	158.9	Agarthala	35.1	Agarthala	32.8
Aizawl	173.3	Aizawl	25.7	Aizawl	46.2
Banglore	156.1	Banglore	223	Banglore	155.9
Bhuvaneshwar	126.1	Bhuvaneshwar	104	Bhuvaneshwar	36.9
Chandighar	43.5	Chandighar	178.6	Chandighar	146.4
Chennai	160.6	Chennai	201.2	Chennai	135.7
Dehradun	43.5	Dehradun	165.9	Dehradun	134
Gangtok	126.6	Gangtok	57.7	Gangtok	53
Panaji	128.7	Panaji	239.1	Panaji	171.7
Hyderabad	109.5	Hyderabad	185.9	Hyderabad	118.3
Imphal	182.7	Imphal	9.5	Imphal	62
Itanagar	176.1	Itanagar	16.6	Itanagar	73
Jaipur	0	Jaipur	182.7	Jaipur	135.5
Kohima	183	Kohima	0	Kohima	67.7
Kolkota	135.5	Kolkota	67.7	Kolkota	0
Lucknow	50.2	Lucknow	132.2	Lucknow	89
Mumbai	92.9	Mumbai	230.5	Mumbai	166
Patna	93.8	Patna	90.2	Patna	47.1
Ranchi	103.6	Ranchi	92.4	Ranchi	32.2
Raipur	86.4	Raipur	136.4	Raipur	71
Srinagar	80.2	Srinagar	207.7	Srinagar	183.9
Shimla	48.3	Shimla	176.2	Shimla	145.9
Shillong	160.8	Shillong	22.4	Shillong	48.8
Trivadrum	205.2	Trivadrum	263.7	Trivadrum	198.7
Dispur	195.9	Dispur	69	Dispur	104.2
Gandhinagar	65	Gandhinagar	220.7	Gandhinagar	161.2
Bhopal	43.6	Bhopal	171.1	Bhopal	112.5

LUCKNOW		MUMBAI		PATNA	
Agarthala	109.3	Agarthala	197.9	Agarthala	65.2
Aizawl	123.5	Aizawl	212	Aizawl	79.5
Banglore	158	Banglore	84.1	Banglore	160.8
Bhuvaneshwar	88.9	Bhuvaneshwar	136.6	Bhuvaneshwar	60.1
Chandighar	59	Chandighar	136.2	Chandighar	99.5
Chennai	153.1	Chennai	103.1	Chennai	148
Dehradun	47.7	Dehradun	136.1	Dehradun	87
Gangtok	76.3	Gangtok	185.5	Gangtok	39.8
Panaji	146	Panaji	40.6	Panaji	162.4
Hyderabad	108.3	Hyderabad	62.1	Hyderabad	114.3
Imphal	132.3	Imphal	226.7	Imphal	89.2
Itanagar	125.8	Itanagar	230.2	Itanagar	86.2
Jaipur	50.5	Jaipur	92.9	Jaipur	93.8
Kohima	132.2	Kohima	230.5	Kohima	90.2
Kolkota	89	Kolkota	166	Kolkota	47.1

City			City			City	
Lucknow	0		Lucknow	119.9		Lucknow	109.3
Mumbai	119.9		Mumbai	0		Mumbai	145.7
Patna	44.1		Patna	145.7		Patna	0
Ranchi	59		Ranchi	138		Ranchi	25.1
Raipur	62.8		Raipur	94.9		Raipur	60.1
Srinagar	99.3		Srinagar	186.6		Srinagar	136.8
Shimla	59.6		Shimla	141.2		Shimla	98.8
Shillong	110.2		Shillong	208.6		Shillong	67.8
Trivadrum	208.5		Trivadrum	125		Trivadrum	209.1
Dispur	108.9		Dispur	210.5		Dispur	67
Gandhinagar	92.8		Gandhinagar	54.7		Gandhinagar	160.7
Bhopal	53.3		Bhopal	66.8		Bhopal	82.2

RANCHI			**RAIPUR**			**SRINAGAR**	
Agarthala	60.7		Agarthala	103.1		Agarthala	196
Aizawl	75.3		Aizawl	117.1		Aizawl	208.2
Banglore	141.2		Banglore	101.2		Banglore	236.3
Bhuvaneshwar	35		Bhuvaneshwar	45		Bhuvaneshwar	188.3
Chandighar	117.8		Chandighar	116.2		Chandighar	41.5
Chennai	125.9		Chennai	91.7		Chennai	239.8
Dehradun	105.9		Dehradun	107.2		Dehradun	51.6
Gangtok	55.2		Gangtok	97.9		Gangtok	151.5
Panaji	148.8		Panaji	104.4		Panaji	207
Hyderabad	97.5		Hyderabad	54.2		Hyderabad	189.3
Imphal	88.9		Imphal	132.1		Imphal	211.4
Itanagar	93.1		Itanagar	137.8		Itanagar	195.5
Jaipur	103.6		Jaipur	86.4		Jaipur	80.2
Kohima	92.4		Kohima	136.4		Kohima	207.7
Kolkota	32.2		Kolkota	671		Kolkota	183.9
Lucknow	59		Lucknow	62.8		Lucknow	99.3
Mumbai	138		Mumbai	94.9		Mumbai	168.6
Patna	25.9		Patna	60.1		Patna	136.8
Ranchi	0		Ranchi	44.7		Ranchi	157.1
Raipur	44.7		Raipur	0		Raipur	157.7
Srinagar	157.1		Srinagar	157.7		Srinagar	0
Shimla	118		Shimla	118.3		Shimla	89.8
Shillong	70.7		Shillong	115.1		Shillong	189.5
Trivadrum	188		Trivadrum	1505		Trivadrum	285.4
Dispur	72.3		Dispur	136.1		Dispur	185.5
Gandhinagar	117.8		Gandhinagar	120.5		Gandhinagar	166.8
Bhopal	81		Bhopal	49		Bhopal	122.8

DISPUR		GANDHINAGAR		BHOPAL	
Agarthala	31.1	Agarthala	191.3	Agarthala	141.5
Aizawl	48.8	Aizawl	24.3	Aizawl	156.1
Banglore	208.6	Banglore	125.5	Banglore	114.4
Bhuvaneshwar	89.3	Bhuvaneshwar	177.6	Bhuvaneshwar	93.3
Chandighar	155.4	Chandighar	93	Chandighar	83.2
Chennai	189.1	Chennai	177.7	Chennai	117.1
Dehradun	142.6	Dehradun	115.5	Dehradun	78.6
Gangtok	34.2	Gangtok	219.6	Gangtok	121.4
Panaji	220.9	Panaji	110.6	Panaji	94.2
Hyderabad	168.3	Hyderabad	89.1	Hyderabad	66.4
Imphal	21.5	Imphal	299.9	Imphal	168.8
Itanagar	32.7	Itanagar	215.2	Itanagar	168.5
Jaipur	195.9	Jaipur	65	Jaipur	43.6
Kohima	69	Kohima	220.7	Kohima	171.1
Kolkota	104.2	Kolkota	161.2	Kolkota	112.5
Lucknow	108.9	Lucknow	92.8	Lucknow	53.3
Mumbai	210.5	Mumbai	54.7	Mumbai	66.8
Patna	67	Patna	160.7	Patna	82.2
Ranchi	72.3	Ranchi	175.2	Ranchi	81
Raipur	136.1	Raipur	120.5	Raipur	49
Srinagar	185.5	Srinagar	166.8	Srinagar	122.8
Shimla	150.5	Shimla	98.3	Shimla	87.1
Shillong	150.5	Shillong	258.8	Shillong	148.7
Trivadrum	251.3	Trivadrum	170.3	Trivadrum	164.4
Dispur	0	Dispur	252.3	Dispur	148.9
Gandhinagar	252.3	Gandhinagar	0	Gandhinagar	63.7
Bhopal	148.9	Bhopal	63.7	Bhopal	0

SHIMLA		SHILLONG		TRIVADRUM	
Agarthala	160.7	Agarthala	20.2	Agarthala	229
Aizawl	173.7	Aizawl	22	Aizawl	238.7
Banglore	201.5	Banglore	204.7	Banglore	50.5
Bhuvaneshwar	148.6	Bhuvaneshwar	85.7	Bhuvaneshwar	162
Chandighar	100.3	Chandighar	158.5	Chandighar	247.4
Chennai	202.7	Chennai	184.3	Chennai	62.9
Dehradun	12	Dehradun	145.7	Dehradun	243
Gangtok	118.6	Gangtok	37.9	Gangtok	243.1
Panaji	176.9	Panaji	218.4	Panaji	84.7
Hyderabad	153.1	Hyderabad	165.8	Hyderabad	100.2
Imphal	178.7	Imphal	22.4	Imphal	256.1
Itanagar	165.7	Itanagar	24.2	Itanagar	271.5
Jaipur	48.3	Jaipur	160.8	Jaipur	205.2
Kohima	176.2	Kohima	22.4	Kohima	263.7
Kolkota	145.9	Kolkota	48.8	Kolkota	198.7

Lucknow	59.6		Lucknow	110.2		Lucknow	208.5
Mumbai	141.2		Mumbai	208.6		Mumbai	125
Patna	98.8		Patna	67.8		Patna	209.1
Ranchi	118		Ranchi	70.7		Ranchi	188
Raipur	118.3		Raipur	115.1		Raipur	150.5
Srinagar	39.8		Srinagar	189.5		Srinagar	285.4
Shimla	0		Shimla	156.4		Shimla	251.4
Shillong	156.4		Shillong	0		Shillong	247.2
Trivadrum	251.4		Trivadrum	247.2		Trivadrum	0
Dispur	150.5		Dispur	9		Dispur	251.3
Gandhinagar	98.3		Gandhinagar	258.8		Gandhinagar	170.3
Bhopal	87.1		Bhopal	148.7		Bhopal	164.4