Hints to assignment 2 (Total marks: 80)

April 23, 2012

- **15.1, 6 marks** Use the recurrence

$$C(i,j) = \begin{cases} distance(p_i, p_j) & i = 1, j = 2 \\ C(i, j-1) + distance(p_{j-1}, p_j) & i < j-1 \\ \min_{1 \le k < i}\{C(k,i) + distance(p_k, p_j) & j > 2, i = j-1 \end{cases}$$

  where $C(i,j)$ is length of a shortest bitonic path between p_i and p_j.

- **23-1, marks: 1,2,2,2** Add an edge e_1 from $G \setminus T$ to T. Remove an edge e_2 from the unique cycle formed. For some choice of e_1, e_2 the weight increase is minimum.

- **23.1-4, 3 marks** A cycle with all edges of equal weight make a counter example.

- **23-4, marks: 2,2,2** Yes, No, Yes.

- **23.1-11, 4 marks** Put the new edge in the tree, remove max wt edge from the cycle formed.

- **24.1-3, 2 marks** In every iteration, update a flag variable if any d value changes. There will be no change after m iterations.

- **24-2, marks: 1,2,3** a. Trivial b. Sort the dimensions of each box in nondecreasing order. Compare coordinatewise.

  c. Just reduces to finding a longest path in a DAG.

- **24-4, marks: 2 each=12** a. Dijkstra's algorithm with counting sort.

  b. BFS.

  c. Trivial.

  d. Triangle inequality.

- **25.1-5, 3 marks** After calculating L^{n-1} as in the book, multiply with a column vector with sth entry 1 and rest 0s.

- **26.2-8, 3 marks** On each s to t path, there is an edge with 0 residual capacity once the max flow is set. Remove this edge and repeat this process. There can be at most $|E|$ iterations.

- **26.2-10, 4 marks** Both $\delta(s,u)$ and $\delta(v,t)$ reduce by 2.

- **26.3-5, 6 marks** Show that every cut in the graph is of capacity at least n by taking a generic cut.

- **1, marks: 1,1,3,3**

- **2, 5 marks**

- **3, 5 marks**