

**CS3230 Tutorial (Approximation Algorithms, week of 10 April)**

1. Approximation Algorithms (textbook page 450).
  - a. Apply the nearest-neighbor algorithm to the instance defined by the distance matrix below. Start the algorithm at the first city, assuming that the cities are numbered from 1 to 5.

0	14	4	10	$\infty$
14	0	5	8	7
4	5	0	9	16
10	8	9	0	32
$\infty$	7	16	32	0

- b. Compute the accuracy ratio of this approximate solution.
2. Prove that making a shortcut of the kind used by the twice-around-the-tree algorithm cannot increase the tour's length in an Euclidean graph.
3. Consider the greedy algorithm for the bin-packing problem, which is called the **first-fit (FF) algorithm**: place each of the items in the order given into the first bin the item fits in; when there are no such bins, place the item in a new bin and add this bin to the end of the bin list.
  - a. Apply FF to the instance:
 
$$s_1 = 0.4, \quad s_2 = 0.7, \quad s_3 = 0.2, \quad s_4 = 0.1, \quad s_5 = 0.5$$
4. Design a simple 2-approximation algorithm for finding a **minimum vertex cover** (a vertex cover with the smallest number of vertices) in a given graph.