Algorithms and Problem Solving (15B11CI411)
Tutorial – 9
Week 9 (19-24 March, 2018)
(Greedy Algorithms/Back Tracking)

Q1. Consider the making change problem in the country of India. The input to this problem is an integer *M*. The output should be the minimum number of coins to make *M* rupees of change. In India, assume the available coins are 1,5,10,20,25,50 rupees. Assume that we have an unlimited number of coins of each type.
Apply the greedy algorithm which takes as many coins as possible from the highest denominations. So for example, to make change for 234 rupees the greedy algorithm would take four 50 rupee coins, one 25 rupee coin, one 5 rupee coin, and four 1 rupee coins. Does the greedy approach give the optimum results?

Q2. Consider a country with very long roads and houses along the road. Assume that the residents of all houses use cell phones. We want to place cell phone towers along the road, and each cell phone tower covers a range of 7 miles. Create an efficient algorithm that allow for the fewest cell phone towers.

Q3. Let us consider a customer-care server (say, mobile customer-care) with n customers to be served in the queue. For simplicity assume that the service time required by each customer is known in advance and it is *wt* minutes for customer *i*. So if, for example, the customers are served in order of increasing *i*, then the *ith* customer has to wait: $\sum_{i=1}^{n-1}$ wi *minutes*. The total waiting time of all customers can be given as $\sum_{i=1}^{n-1} \quad \sum_{j=1}^{i-1}$ wj. What is the best way to serve the customers so that the total waiting time can be reduced?

Q4. Apply backtracking to solve the following instance of the subset sum problem: $A = \{3, 5, 6, 7\}$ and $d = 15$ where d is total sum. Show the complete state-space tree.

Q5. Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph: