

Part 1

- 1) What is the difference between Logistics and Supply Chain Management ? (3 points)
- 2) Which are the main benefit of a “vertically integrated” supply chain ? (4 points)
- 3) When direct shipping is appropriate ? Explain the conditions and the advantages of direct shipping? (4 points)
- 4) Which are the types of freight consolidation that can be performed (4 points)
- 5) Make examples of strategic, tactical and operational decisions within SCM (3 points)

Part 2

- 1) Which are the main types of warehouse network design models (e.g. single and multi-echelon...) ? (4 points)
- 2) Given the following Capacitated location model where V_1 is the set of potential facility locations and V_2 is the set of demand points, modify it so as to impose that no more than p facilities are open, and at least one between facilities 1 and 3 are open (4 points)

$$\text{minimize } \sum_{i \in V_1} \sum_{j \in V_2} c_{ij} s_{ij} + \sum_{i \in V_1} f_i y_i$$

subject to

$$\sum_{j \in V_2} s_{ij} \leq q_i y_i, \quad i \in V_1,$$

$$\sum_{i \in V_1} s_{ij} = d_j, \quad j \in V_2,$$

$$s_{ij} \geq 0, \quad i \in V_1, j \in V_2,$$

$$y_i \in \{0,1\}, \quad i \in V_1.$$

- 3) Explain the holding and obsolescence cost in inventory holding? (3 points)
- 4) What are the main assumptions leading to Economic Order Quantity formula and which is its expression and meaning? (4 points)
- 5) What is the function of the Reserve and Forward zones in a warehouse ? (3 points)

Part 3

- 1) What is Longhaul transportation model and which are the relevant cost components ? (3 points)
- 2) What is the general structure of a network flow problem used to model freight traffic assignment (list the main components of the graph model, the decision variables and the main constraints)? (4 points)
- 3) What is a container relocation problem and how can be modeled ? (3 points)
- 4) What is the difference between sequential and parallel insertion algorithms for the VRP? (3 points)
- 5) How does a route-first-cluster-second algorithm works? (4 points)