*Fundamentals of Traffic Operations and Control*
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*Exercise*
*Logistics*

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1. Consider the following ILP:

$$\max 5x_1 + 4x_2 \tag{1}$$

$$s.t. \;\; 6x_1 + 13x_2 \leq 67 \tag{2}$$

$$8x_1 + 5x_2 \leq 55 \tag{3}$$

$$x_1, x_2 \geq 0 \;\; integer \;\; valued \tag{4}$$

   (a) Using the graphical method, find the LP Optimum for the ILP relaxation.

   (b) Using the Branch-and-Bound method, find the solution to the ILP.

2. The owner of the bar "SatelliteâĂİ at EPFL would like to know how many boxes of"TempêteâĂİ should be ordered from the Dr. Gab's factory, as well as the frequency of such orders. Over the past year, demand has averaged 10 boxes per day. Although the demand is not the same each day, it rarely exceeds or falls below the average by much. Consequently, the owner of Sat feels confident using an annual demand of 3600 boxes considering there are 360 days per year. Because of its long-standing relationship with the Dr. Gab's brewery, Sat receives an excellent delivery service, almost always receiving an order five days after placing it. In cooperation with its accountants, Sat estimates that an order of Q boxes per year from the vendor costs 75+16Q CHF. Sat also estimates that the holding cost would be CHF4 for all boxes during a cycle time, 25% of a box's unit cost. Sat's current policy calls for an order of 600 boxes to arrive every 60 days. Since daily demand is about 10 boxes per day, the arrival of 600 boxes every 60 days has led to very few stockouts. However, Sat is ensure whether its current policy is optimal. Perhaps, it should order less frequently but in larger quantities (e.g. 1200 boxes every 120 days) or more frequently is smaller quantities (e.g. 150 boxes every 15 days). Sat is willing to change its current ordering policy but wants to ensure that stockout under the new policy are also infrequent.

   (a) Using the total cost formula seen in class, can you estimate the total cost Sat would pay (on a yearly basis) for the three proposed options?

   (b) Can you come up with a better order quantity and frequency?

3. Run Dijkstra's algorithm on the directed graph in the figure below. Show the state of the graph at each iteration of the algorithm.