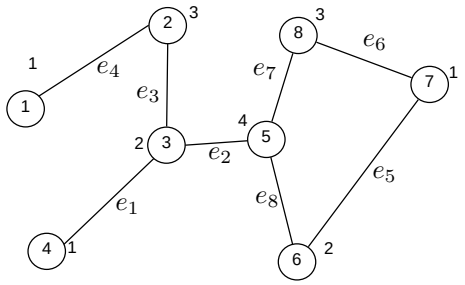
5 Exercise Set No. 5

1) Minimum weighted vertex cover problem: Consider the minimum vertex cover problem discussed in the class (Example 21 in the lecture notes). Suppose that the installation cost is variable for different nodes and is given by w_k for the k^{th} one.

1. Make necessary changes in the ILP optimization given in the class to minimize the overall installation costs in this case. Write the modified ILP for the general case.

2. Consider the following example:



   The numbers on the nodes (outside the circles) show the installation costs. The numbers inside the circles are the node indexes. The edges are indexed by $e_1, e_2, \ldots, e_8$. Make necessary changes in the primal dual algorithm given in the class to approximately solve this example. Write down the result of the algorithm in the following format: At each line, write which edge you selected, what is the updated dual parameter and what the set of active constraint (the node set) becomes.

   To simplify correction and grading, start from the zero dual variables. If you have multiple choices for the edges, select the one with the smallest index.

3. Modify the given proof in the lecture notes to show that in general the cost of installation for the result of the above primal algorithm is not larger than 2 times the optimal cost.

4. For the example in the figure, give another approximate solution by first solving the LP rlaxation and obtaining the non-integral solution, then rounding each entry to the nearest integer solution. Write the LP relaxation, the CVX code and the solution. Compare the primal-dual solution with the rounded one. Which one has a smaller cost?