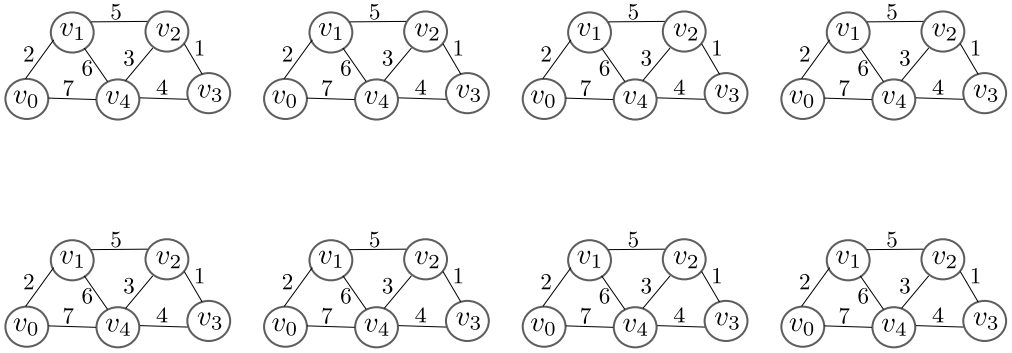
CMPS 2200 Introduction to Algorithms – Fall 17

11/16/17

Lab Worksheet

1. **Kruskal**
   Run Kruskal's algorithm on the graph below. Show all the different stages of the algorithm (tree edges and the set of vertex subsets). Clearly indicate the minimum spanning tree.



2. **Binary Counter**
   Consider a 6-bit binary counter. Show how it changes from 0 when increasing it $n = 16$ times.

   How often does the 0th bit change? How often does the 1st bit change? How often does the 2nd bit change?

3. **Queue from Stacks**

   Assume we are given an implementation of a stack, in which PUSH and POP operations take constant time each. We now implement a FIFO queue using two stacks A and B as follows:

   ENQUEUE(x):
   • Push x onto stack A

   DEQUEUE():
   • If stack B is nonempty, return B.POP()
   • Else, pop all elements from A and immediately push them onto B. Return B.POP()

   (a) Show how the following sequence of operations operates on the two stacks. Suppose the stacks are initially empty.
   Enqueue(1), Enqueue(2), Enqueue(3), Dequeue(), Enqueue(4), Enqueue(5), Enqueue(6), Dequeue(), Dequeue(), Dequeue()

   (b) Why do these implementations of ENQUEUE and DEQUEUE correctly implement FIFO queue behavior? *(Hint: Which invariant holds for A and B?)*