CSCI 3104 Assignment 9

10:00 - 10:50 Wanshan

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1. (a) Start at the root node, then progress through the graph. Once the algorithm reaches the end of a branch, then backtrack and then proceed along the first edge path that hasn't been used yet. If the algorithm is going along a new path but reaches a node that has already been visited, then it is not a spanning tree. If at the end of this all of the nodes were visited and none were visited twice (except during backtracking), then it is a spanning tree.

   (b) The point of a minimum spanning tree is to have the smallest sum of weighted paths connecting the tree. If there is an edge in the tree that is greater than an edge outside of the tree connecting two points, then during the construction of the tree, a safe edge was not added since during the step that added an edge of weight greater than w, the light edge (which is the edge of weight w) was not added. Therefore T is not a MST of G.

   (c) None of the MST Path Greatest Weights are greater than $e : (u, v)$. Therefore T is a MST.

Edge	$e : (u, v)$	MST Path	MST Path Greatest Weight
3, 4	1.0	3-2-7-4	0.8
5, 7	1.2	5-4-7	1.1
6, 7	1.1	6-1-2-7	0.6
6, 8	0.8	6-1-8	0.5
8, 9	0.8	8-1-6-9	0.7
9, 10	0.7	9-6-1-2-7-10	0.7

   (d) e_{min} would be the smallest n edges in the graph up to the point where two weight edges are identical. Since in part B, the construction of an MST consists of adding safe edges, which means all the light edges (the minimum edges between S and V) are appended to the MST. Therefore the smallest n edges (which is e_{min}) must be added to the MST.

   (e) Prim's algorithm only adds safe nodes (which involves taking light edges, edges that satisfy certain requirements as well as takes the lowest weight edges that cross a cut). When node u is the starting node, the algorithm will take the edge (u, v) because it is a safe edge (it crosses a cut that respects T and is a light edge).

   (f)
   - The same tree except with the edge $9 - 10$ instead of $7 - 10$.
   - The same tree except with the edge $9 - 10$ instead of $6 - 9$.

2. (a) There are 25 decision variables from x_{11} to x_{55}, represented in the general form x_{ij}. When person i does task j, then x_{ij} is 1, otherwise it is 0.

(b) $x_{15} + x_{25} + x_{35} + x_{45} + x_{55} = 1$

(c) Assuming $T = 35$.
$x_{41} * T_1 + x_{42} * T_2 + x_{43} * T_3 + x_{44} * T_4 + x_{45} * T_5 = 14$

(d) $A_3 = x_{31} * P_3[0] + x_{31} * P_3[1] + x_{31} * P_3[2] + x_{31} * P_3[3] + x_{31} * P_3[4]$

(e)

```
import math

t = [5, 10, 2, 8, 10]
p = [[2, 1, 3, 4, 5], [3, 2, 4, 1, 5], [4, 2, 3, 5, 1], [1, 2, 3

temp = []
for i in range(24):
    temp.append(0)

mina = 100000
for i in range(0, 21):
    for j in range(i+1, 22):
        for k in range(j+1, 23):
            for l in range(k+1, 24):
                for m in range(l+1, 25):
                    a = p[int(math.floor(i/5))][i % 5] +
                        p[int(math.floor(j/5))][j % 5] +
                        p[int(math.floor(k/5))][k % 5] +
                        p[int(math.floor(l/5))][l % 5] +
                        p[int(math.floor(m/5))][m % 5]
                    if a < mina:
                        mina = a
print mina
```

Answer $\boxed{5}$