HW07 for ECE 9343

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1 Question 1: CLRS Exercise 24.1-1

From vertex z : See Figure 1
From vertex s : See Figure 2

2 Question 2: CLRS Exercise 24.2-1

See Figure 3

3 Question 3: CLRS Exercise 24.3-1

See Figure 4

4 Question 4: CLRS Exercise 24.3-6

Consider the modification of Dijkstra's algorithm, growing the reliable tree from one root:

INITIALIZE$(G, root)$

```
1  for each v ∈ G.V
2      v.d = 0
3      v.π = nullptr
4  root.d = 1
```

RELAX(u, v, r)

```
1  if u.d < v.d * r(u, v)
2      u.d ← v.d * r(u, v)
3      v.π ← u
```

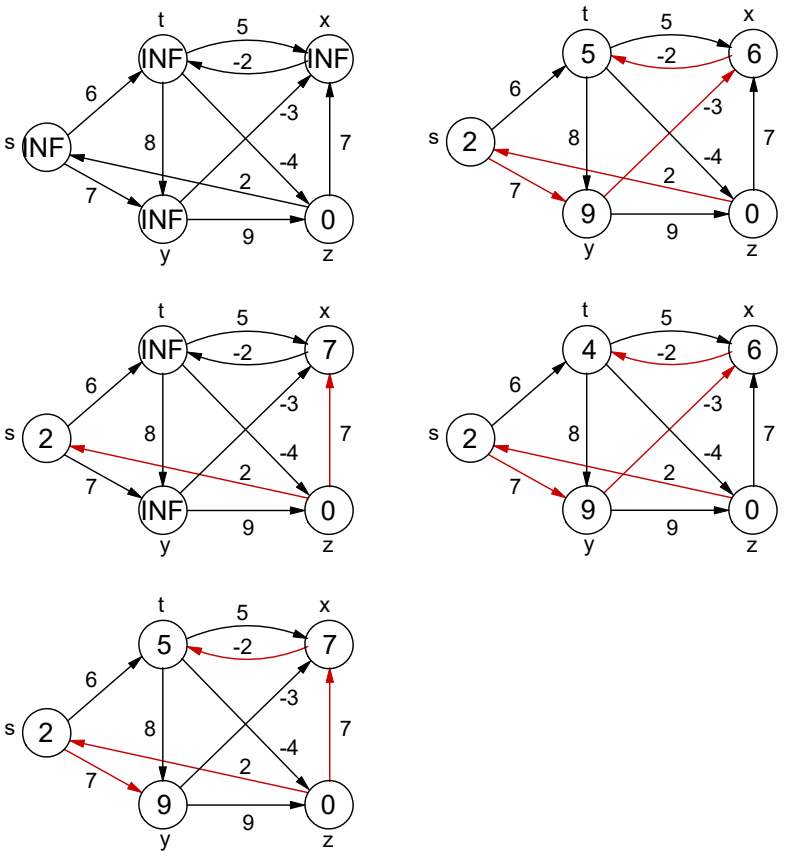

Figure 1: Exercise 24.1-1, part1

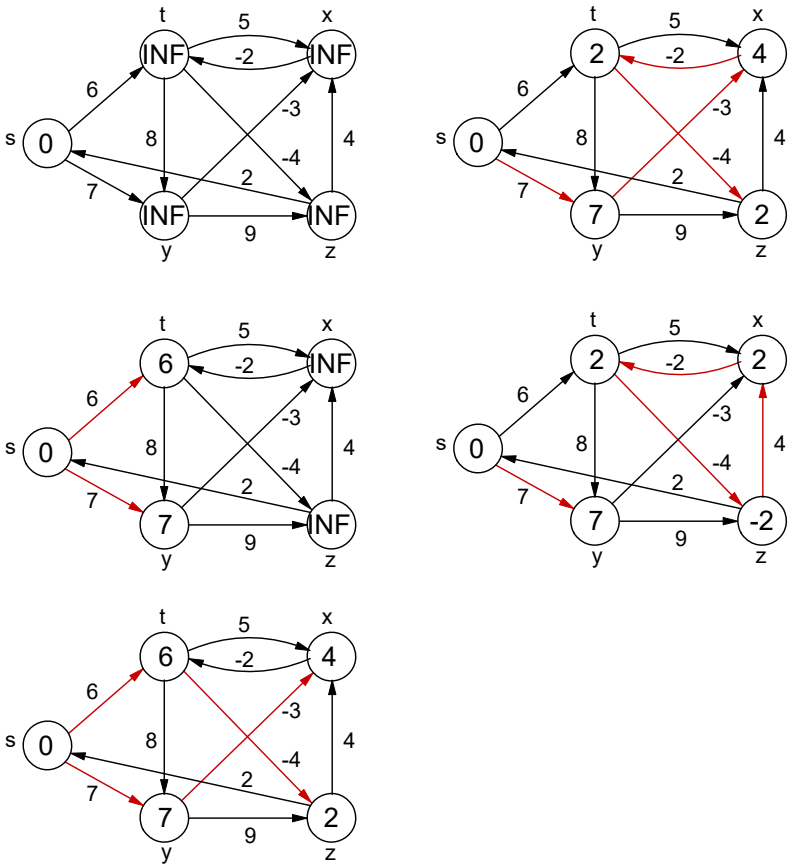

Figure 2: Exercise 24.1-1, part2

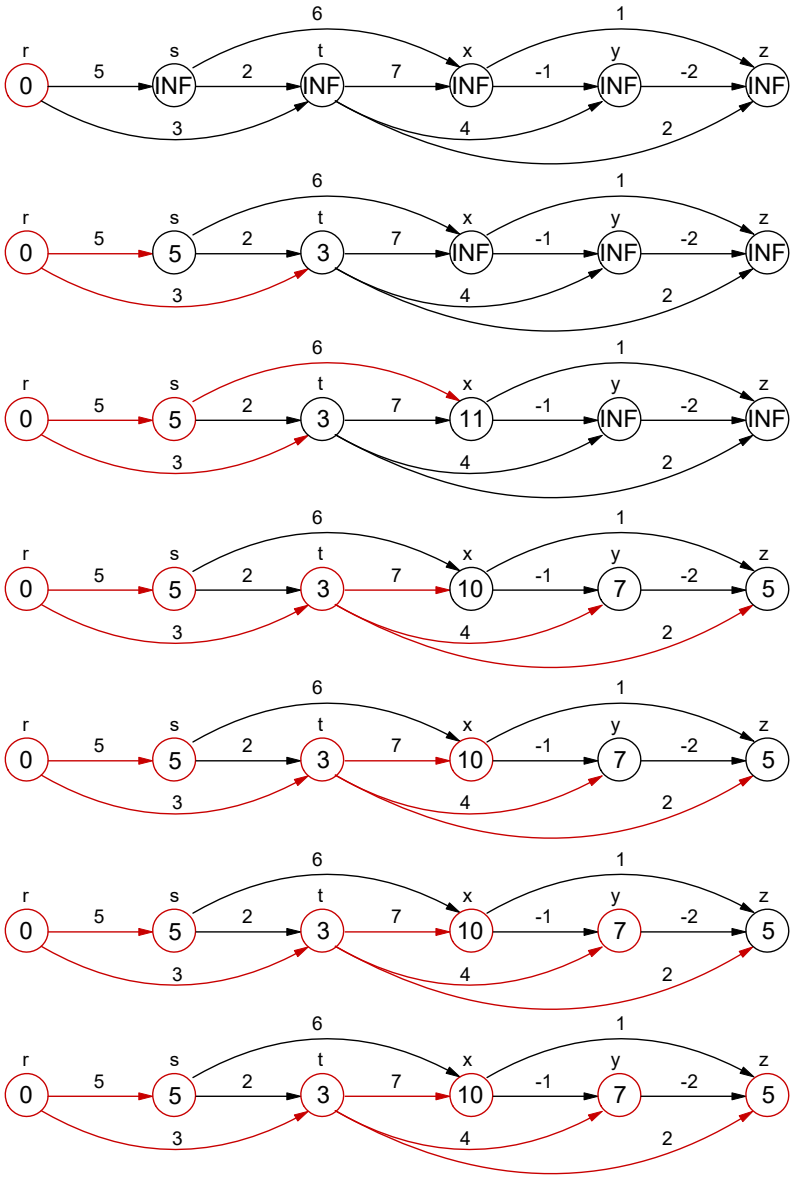

Figure 3: Exercise 24.2-1

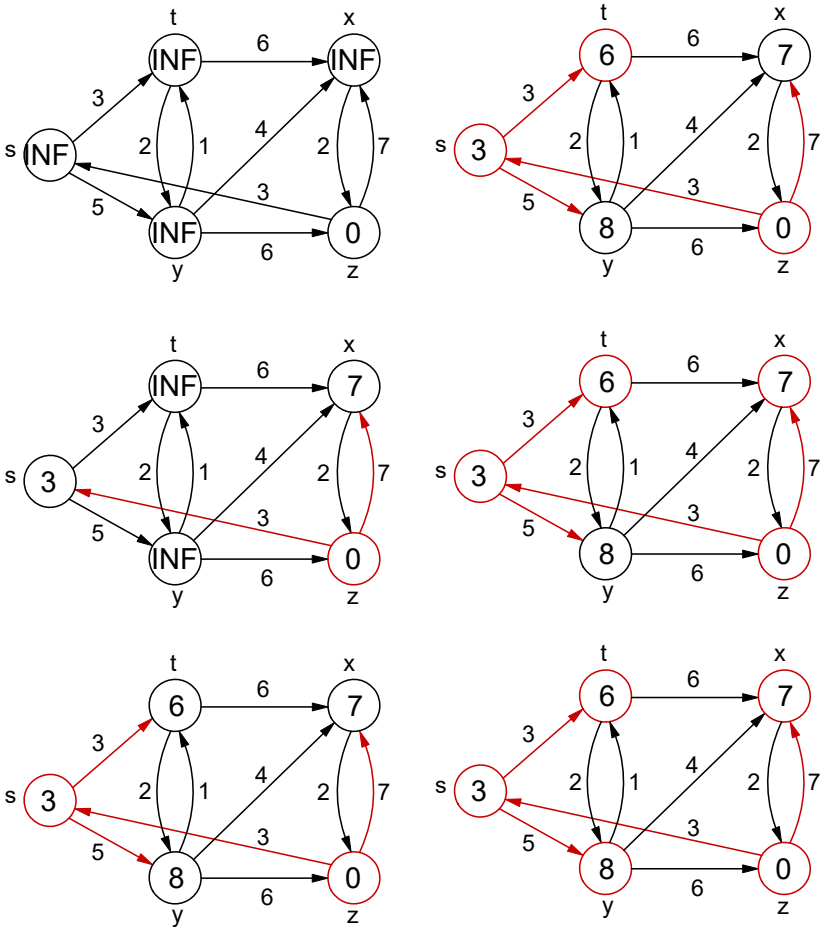

Figure 4: Exercise 24.3-1

RELIABLE-PATH-SEARCH$(G, root)$

```
1  INITIALIZE(G, root)
2  Q ← G.V
3  while !Q.empty
4        u = EXTRACT-MAX(Q)
5        for each v ∈ G.E(u)
6              RELAX(u, v, G.r)
```

PRINT-PATH$(G, root, v)$

```
1  if v = root
2        return
3  else
4        if v.π = nullptr
5              PRINT(NO SUCH PATH)
6        else
7              PRINT-PATH(G, r, v.π)
8              PRINT(V)
```

5 Question 5: CLRS Exercise 25.2-1

$$D_0 = \begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & \infty & \infty \\ \infty & 2 & 0 & \infty & \infty & -8 \\ -4 & \infty & \infty & 0 & 3 & \infty \\ \infty & 7 & \infty & \infty & 0 & \infty \\ \infty & 5 & 10 & \infty & \infty & 0 \end{pmatrix} \quad D_1 = \begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & 0 & \infty \\ \infty & 2 & 0 & \infty & \infty & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ \infty & 7 & \infty & \infty & 0 & \infty \\ \infty & 5 & 10 & \infty & \infty & 0 \end{pmatrix}$$

$$D_2 = \begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & 0 & \infty \\ 3 & 2 & 0 & 4 & 2 & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix} \quad D_3 = \begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ 1 & 0 & \infty & 2 & 0 & \infty \\ 3 & 2 & 0 & 4 & 2 & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix}$$

$$D_4 = \begin{pmatrix} 0 & \infty & \infty & \infty & -1 & \infty \\ -2 & 0 & \infty & 2 & 0 & \infty \\ 0 & 2 & 0 & 4 & 2 & -8 \\ -4 & \infty & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix} \quad D_5 = \begin{pmatrix} 0 & 6 & \infty & 8 & -1 & \infty \\ -2 & 0 & \infty & 2 & 0 & \infty \\ 0 & 2 & 0 & 4 & 2 & -8 \\ -4 & 10 & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix}$$

$$D_6 = \begin{pmatrix} 0 & 6 & \infty & 8 & -1 & \infty \\ -2 & 0 & \infty & 2 & 0 & \infty \\ -2 & -3 & 0 & -1 & -3 & -8 \\ -4 & 10 & \infty & 0 & -5 & \infty \\ 8 & 7 & \infty & 9 & 0 & \infty \\ 6 & 5 & 10 & 7 & 5 & 0 \end{pmatrix}$$

6 Question 6: CLRS Exercise 25.2-2

Consider the following dynamic programming function:

$$t_{ij}^{m} = \begin{cases} i = j & m = 0 \\ \bigcup\limits_{1 \le k \le n} (t_{ik}^{m-1} \cap (w_{kj} \neq \infty)) & 1 \le m \le n-1 \end{cases}$$

TRANSITIVE-CLOSURE-BRUTAL-FORCE(G)

```
1  n = G.V
2  l[n][n][n] ← 0
3  for each entry in l[0]
4        l[0][i][j] ← i = j
5  for m ← 1 to n − 1
6        for i ← 1 to n
7              for j ← 1 to n
8                    l[m][i][j] = ⋃_{1≤k≤n} (l[m − 1][i][k] ∩ (G.w_kj ≠ ∞))
```