Quiz

CSCI-4470 Algorithms

Quiz 3 and Quiz 4

Quiz-3

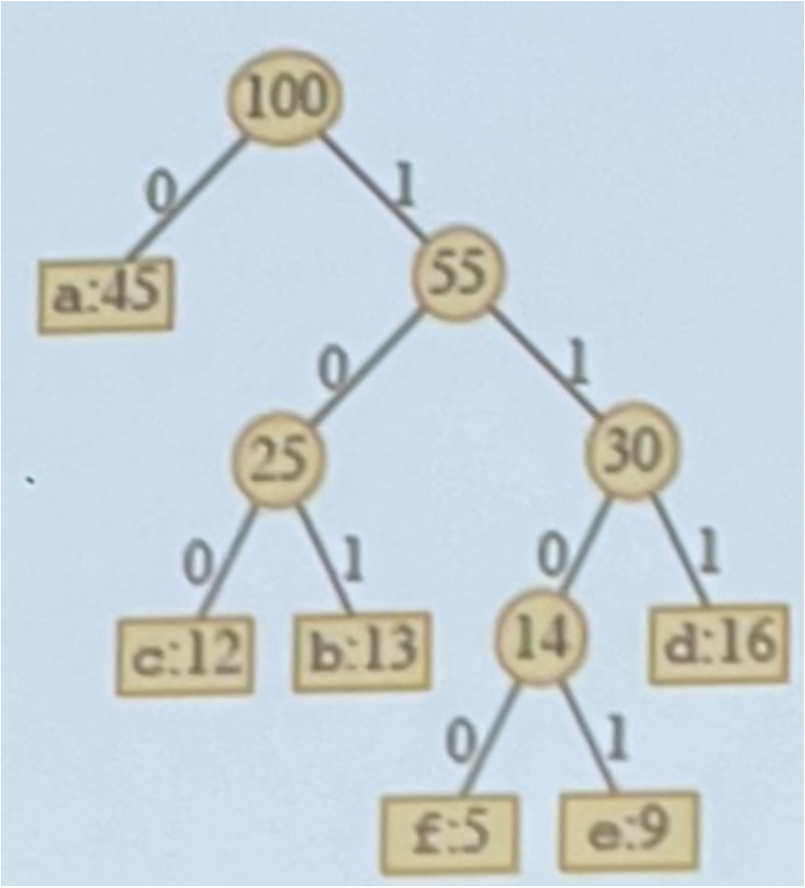
Note: Show all you work and write all your answers on a separate white sheet of paper and at the end submit both your answer sheet and question paper.

1. (2 points) (True/**False**) For a cross edge (u, v) following will always hold $u.d < u.f < v.d < v.f$.
Where $v.d$ and $v.f$ are discover time and finish time of vertex v and $u.d$ and $u.f$ are discover time and finish time of vertex u.

2. (2 points) (True/**False**) In the activity selection problem (activities with start time and finish time) you can find a optimal solution (maximal set) by selecting an activity with the shortest time (finish time - start time).

3. (2 points) (**True**/False) Adjacency matrix is more suitable for graph representation when the graph is dense.

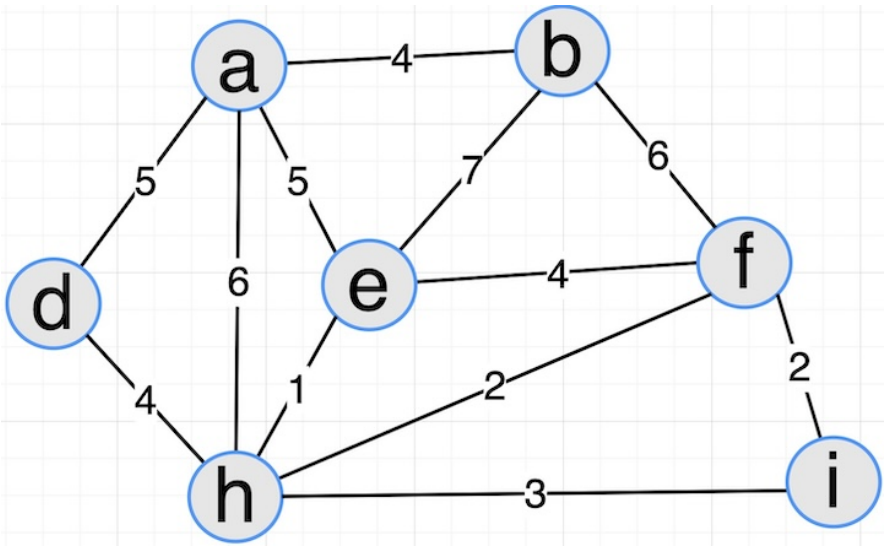
4. (2 points) Below is a Huffman code for the certain alphabets.



What is the encoding for the word “face”

(B) 110011001101
(b) 110001001100
(c) 110001001101
(d) 110001011101

5. (3 points) Consider the following graph.



Which of the following are the light edges for some cut (S, V-S), Select all that apply.

(a) (f,h)
(b) (b,e)
(c) (a,d)
(d) (c,h)
(e) (a,h)

- **Light Edges are nothing but the edges in MST**

6. (2 points) Consider the graph from the above question (Q5). Which of the following is not a valid BFS sequence.

(a) d, a, h, e, b, i, f
(b) i, h, f, d, a, e, b
(c) h, e, f, i, d, a, b
(d) b, e, a, f, h, d, i
(e) All of the above are valid BFS sequences.

7. (4 points) Consider the graph below. You did DFS in alphabetical order on this graph. List all the back edge, cross edge and forward edge

> Back Edges: (w,t), (z,x), (y,q)
> Forward Edges: (q,w)
> Cross Edges: (r,y), (u,y)

8.

> ratio: $\frac{15}{1}, \frac{13}{3}, \frac{12}{6}, \frac{9}{6}, \frac{5}{4}, \frac{3}{3}$
> Weight: $1 + 3 + 6 + 2 = 12$
> Value: $15 + 13 + 12 + \frac{9}{6} \times 2 = 37$

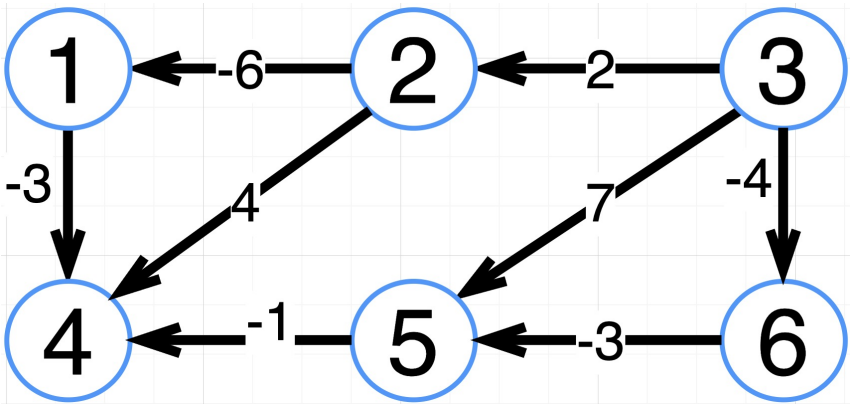
Quiz-4

Note: Show all you work and write all your answers on a separate white sheet of paper and at the end submit both your answer sheet and question paper.

1. (2 points) (True/**False**) Bellman-ford algorithm for the shortest path relaxes the edges of the graph only one time.

- **False**. The Bellman-Ford algorithm relaxes the edges of the graph multiple times, typically up to $V - 1$ times, where V is the number of vertices in the graph.

2. (2 points) Which algorithm is the best choice for finding the single source shortest path graph of G?

- 

(a) Bellman-Ford

(b) DAG-Shortest-Path

(c) Dijkstra

- Dijkstra Not in negative weights

3. (4 points) Consider the graph below.

(a) 14

(b) 13

(c) 9

(d) None of the above

4. (2 points) In the problem above what is the shortest path (sequence of vertices) from vertex s to x.

(a) s,t,x

(b) s,y,z,x

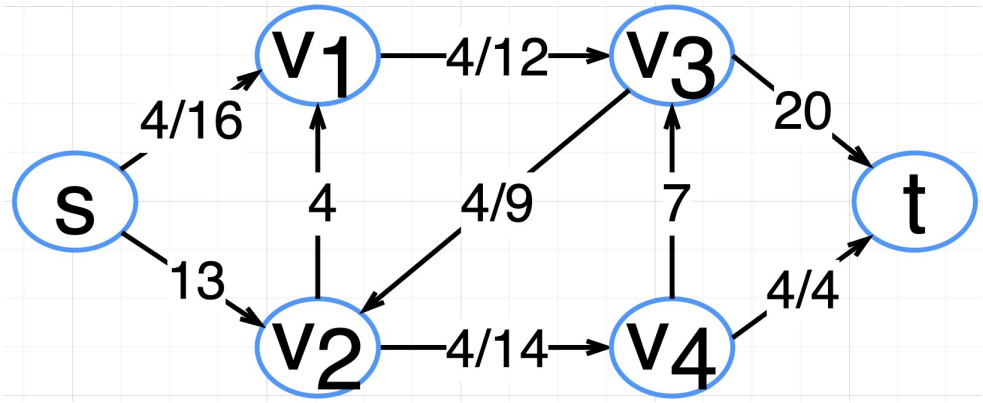
(c) s.y,t,x

(d) None of the above

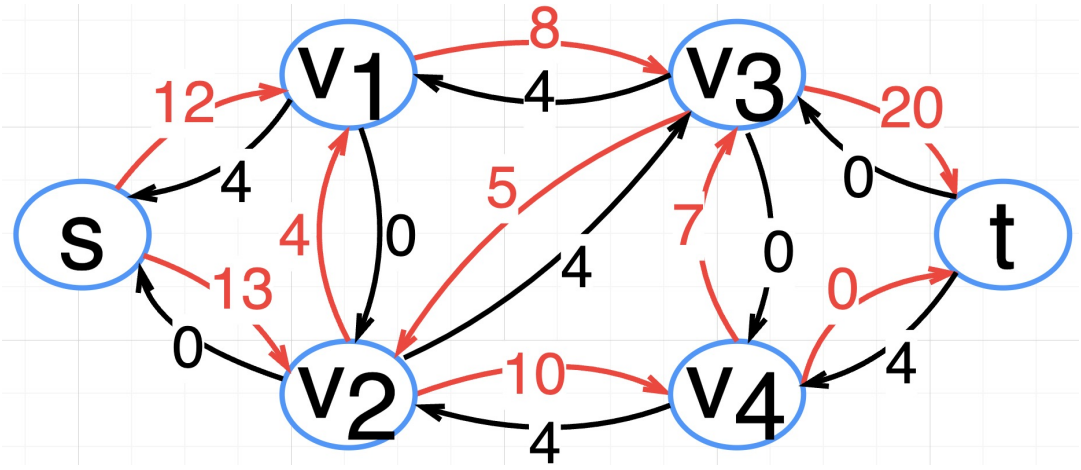
5. (4 points) Show that the augmented flow $(f \uparrow f')(u, v)$ is bounded by the edge capacity c(u, v).

- Known that $f'(u, v) = c(u, v) - f(u, v)$
  $(f \uparrow f')(u, v) = f(u, v) + f'(u, v) - f'(v, u)$
  $(f \uparrow f')(u, v) \leq f(u, v) + f'(u, v)$
  $(f \uparrow f')(u, v) = f(u, v) + c(u, v) - f(u, v)$
  $(f \uparrow f')(u, v) \leq c(u, v)$

6. Consider the following network flow graph. Edge (s, v_1) has a flow of **4** and capacity $c(s, v_1)$ of **16** similarly edge (s, v_2) has a 0 flow and capacity 13.



(a) (4 points) Draw the residual network for this flow.



(b) (3 points) Find one augmenting path in the residual network.

Using this augmenting path increase the flow of the graph. You can highlight the augmenting path in residual network and tell the amount of flow that can increased.

(c) (4 points) Draw a new flow graph with the augmented flow.