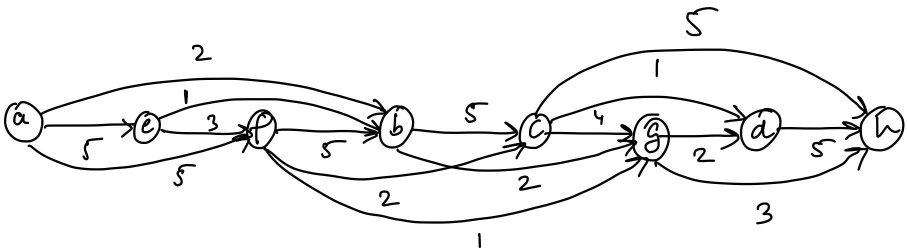
[07] a]

$$D(u,v) = \begin{cases} 0 & \text{if } u=v \\ \infty & \text{if } \deg^{+}(v)=0 \\ \min_{(w,v)\in E}\left(C(w,v) + D(u,w)\right) & \text{otherwise.} \end{cases}$$

b]



c]

$d(a,a) = 0$

$d(a,e) = 5$

$d(a,f) = \min((d(a,e)+3),\ d(a,a)+5) = \min(8,5) = 5$

$d(a,b) = \min((d(a,f)+5),\ (d(a,e)+1),\ (d(a,a)+2))$

$= \min(10, 6, 2) = 2$

$d(a,c) = \min((d(a,f)+2),\ (d(a,b)+5)) = \min(7,7) = 7$

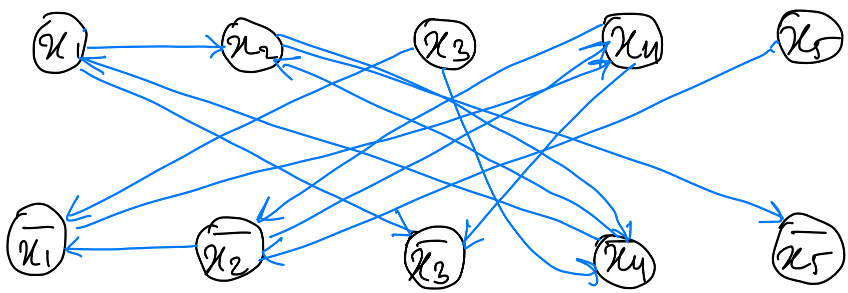
$d(a,g) = \min((d(a,f)+1),\ (d(a,b)+2),\ (d(a,c)+4)) = \min(6,4,11) = 4$

$d(a,d) = \min((d(a,g)+2),\ (d(a,c)+1)) = \min(6,8) = 6$

$d(a,h) = \min((d(a,d)+5),\ (d(a,g)+3),\ (d(a,c)+5)) = \min(11,7,8) = 7$

L08] a]

Clause	Implication	Contrapositive.
$\bar{x}_1, x_2$	$x_1 \to x_2$	$\bar{x}_2 \to \bar{x}_1$
$\bar{x}_1, \bar{x}_3$	$x_1 \to \bar{x}_3$	$x_3 \to \bar{x}_1$
x_1, x_4	$\bar{x}_1 \to x_4$	$\bar{x}_4 \to x_1$
x_2, x_4	$\bar{x}_2 \to x_4$	$\bar{x}_4 \to x_2$
$\bar{x}_2, \bar{x}_4$	$x_2 \to \bar{x}_4$	$x_4 \to \bar{x}_2$
$\bar{x}_2, \bar{x}_5$	$x_2 \to \bar{x}_5$	$x_5 \to \bar{x}_2$
$\bar{x}_3, \bar{x}_4$	$x_3 \to \bar{x}_4$	$x_4 \to \bar{x}_3$



b] $R_{x_1} = \{x_1, x_2, \bar{x}_3, \bar{x}_4, \bar{x}_5\} \to$ consistent.

$\therefore \alpha R_{x_1} = \{x_1 = 1 \quad x_2 = 1 \quad x_3 = 0 \quad x_4 = 0 \quad x_5 = 0\}$.

c] At least 336 queries are needed since for each variable x, we must make sure that either x is not reachable from $\bar{x}$ or $\bar{x}$ is not reachable from x. $\therefore$ In best case, each variable would require one call.

LO9] a] Refer to previous LOs

b] $S = \{12, 15, 17, 24, 26, 27\}$

$t = 70$

$M = 121$

$M/2 = 60.5$

$\because t > M/2$

$\therefore J = 2T - M$

$= 140 - 121$

$= \underline{\underline{19}}$

c] Both are positive instances. In f(s,t) addition of J leads to set partition solution. In the case of (s,t) it leads to t

A' sum $= 70$ $\{12 + 15 + 17 + 26\}$

B' sum $= 121 - 70 + J$

$= \underline{\underline{70}}$

$= \{24, 27, 19\}$.

Made with Goodnotes

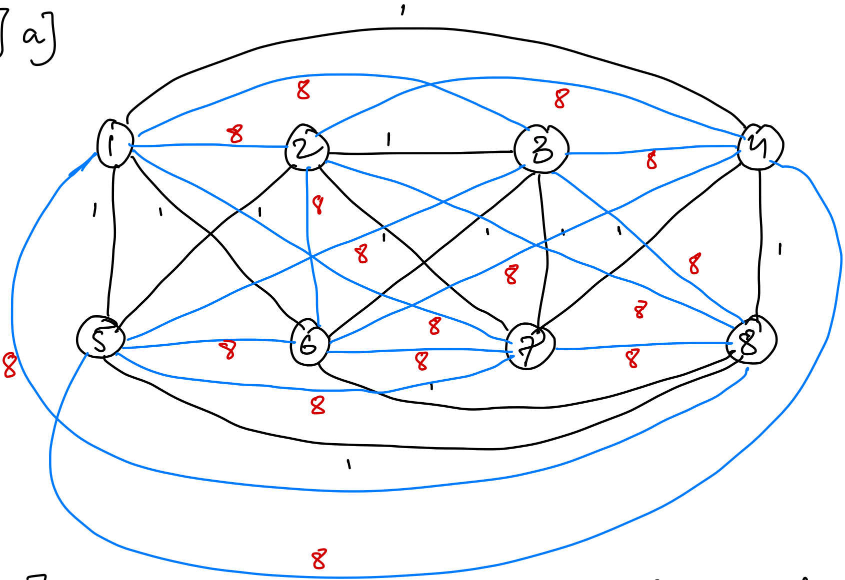
LO10] a] Certificate is a value of x such that $1 \le x \le c$.

b] return $x^2 \% m == a \% m$.

c] b would define the parameter of how big the problem is i.e. how many bits would be required.

d] $O(b^2)$ since both squaring a b-bit no. & computing the remainder of a $O(b)$ bit no. both require $O(b^2)$ steps.

Q11] a]



$k = 8$

for 8 vertices.

b] G has a positive instance of Hamilton cycle on the following path.

$1 \to 4 \to 8 \to 6 \to 3 \to 7 \to 2 \to 5 \to 1.$

Similarily f(G) is also a positive instance as the path $1 \to 4 \to 8 \to 6 \to 3 \to 7 \to 2 \to 5 \to 1$ exists with the same cost 8.

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