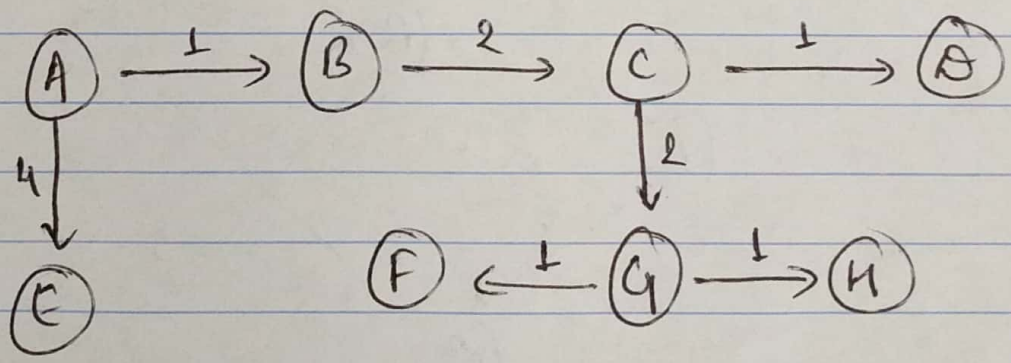
Ganesh Budhathoki

#1 Solution.

(a)

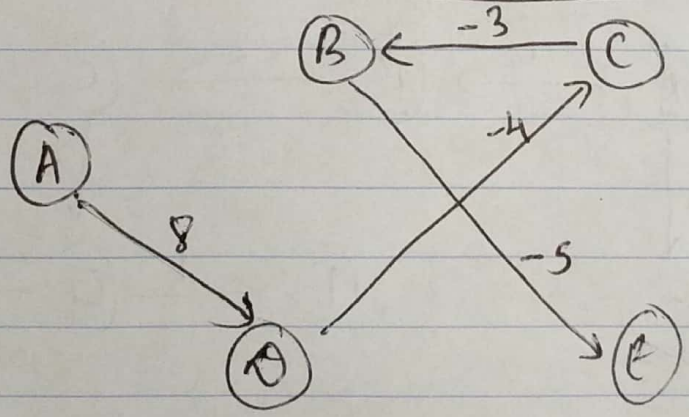
nodes	initially	deg A	deg B	deg C	deg D	deg E	deg G	deg F
A	0, nil							
B	∞, nil	1A						
C	∞, nil		3B					
D	∞, nil			4C				
E	∞, nil	4A						
F	∞, nil	8A	7B				6, G	
G	∞, nil		7B	5C				
H	∞, nil				8D		6, G	

(b)



#2. Solution.

edges	nodes	initially	Iter 1	Iter 2	Iter 3	Iter 4
EA 6	A	0, nil				
AB 6	B	∞, nil	6A		1C	
CB -3						
DB 9						
BC 6	C	∞, nil				
DC -4			12B	4D		
EC 8						
AD 8	D	∞, nil	8A			
BE -5	E	∞, nil	1B		-4B	
DE 7						



→ Which edge above, if any, were used more than once to update the distance value of node?

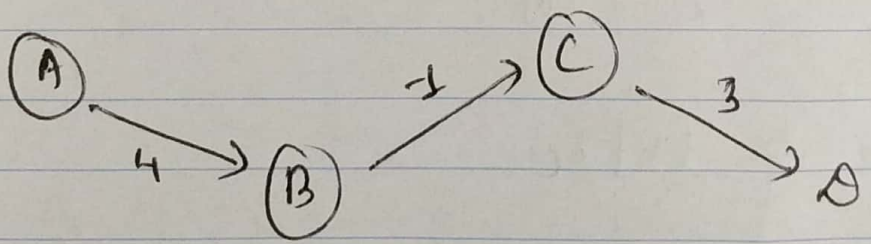
Ans BE

If we run an additional iteration of the algorithm's main loop, does it detect a negative weight cycle?

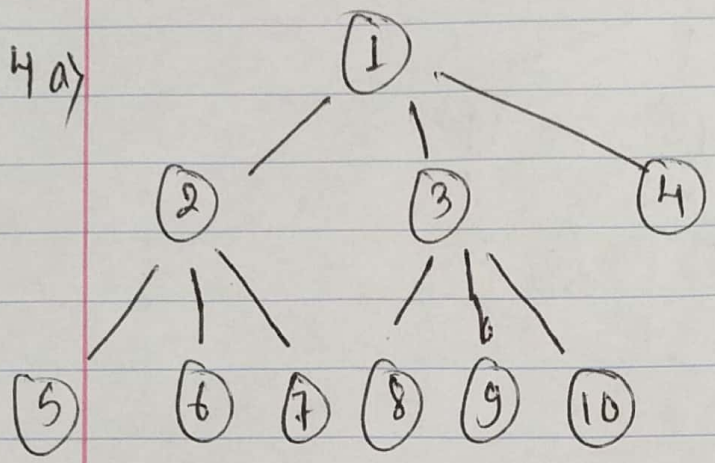
⇒ No.

#3 Solution.

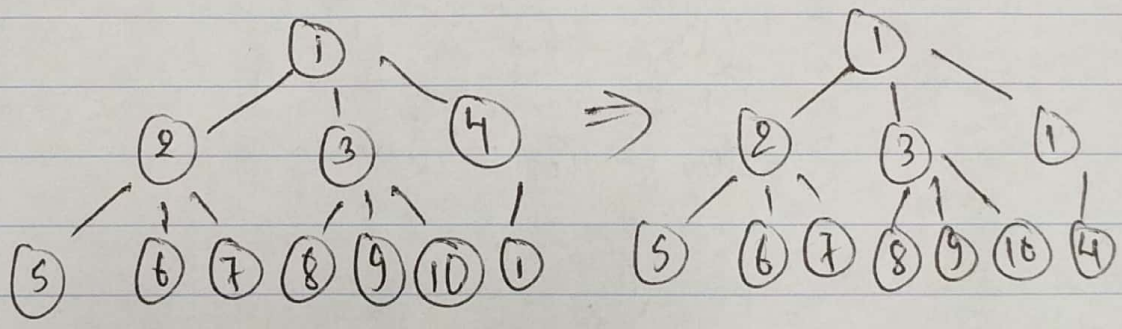
	initially	A	B	C	D
A	0, nil				
B	∞, nil	4 A			
C	∞, nil	4 A	3 B		
D	∞, nil		7 B	6 C	



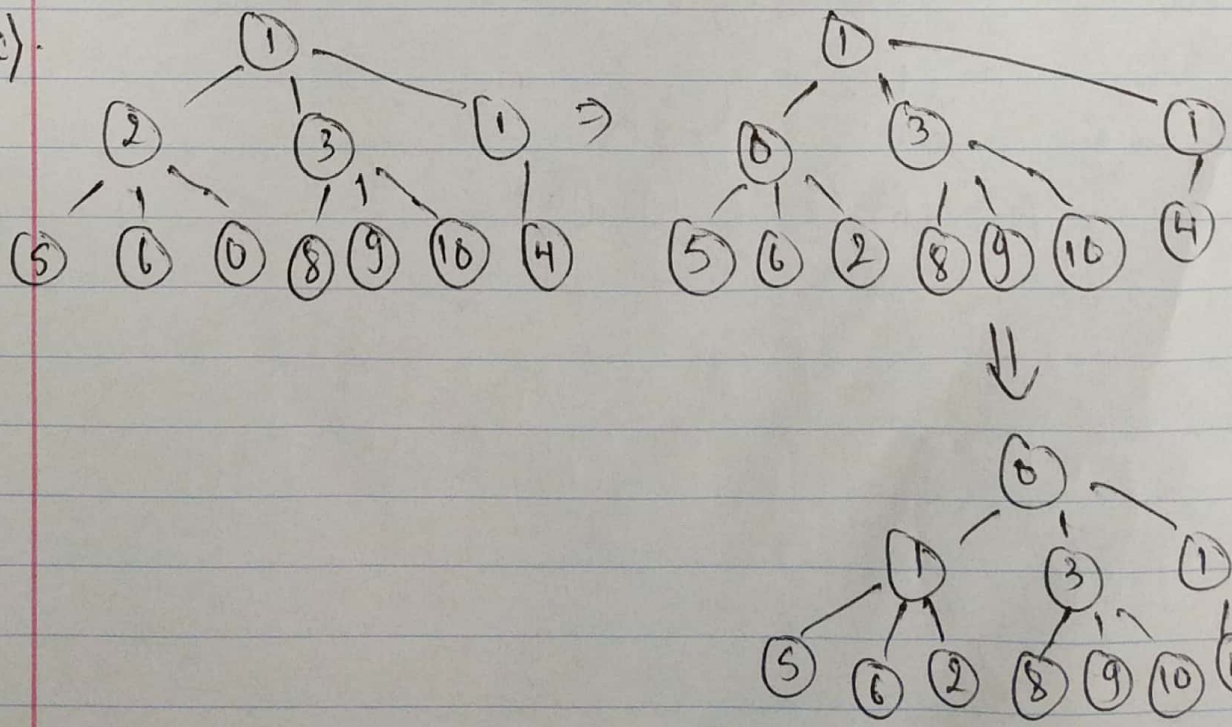
#4a)



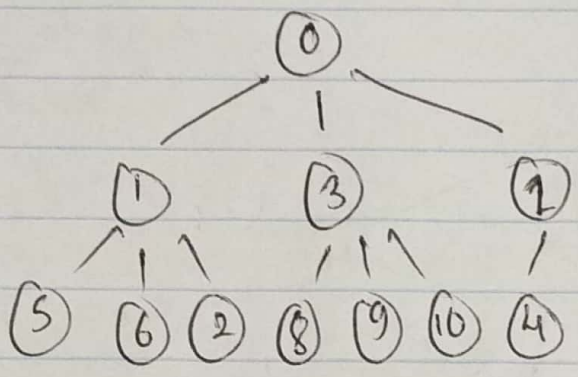
4b)

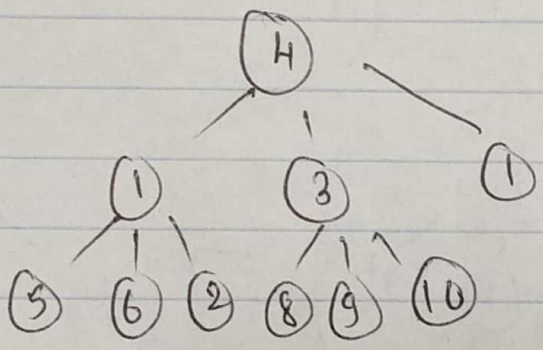


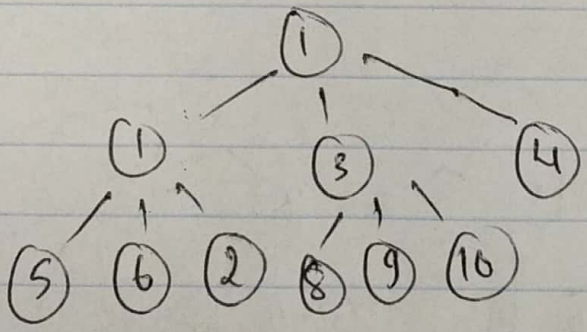
4c)



a)







#

#5 Solution

$$d = |E|/|V|$$

for integer ≥ 2.

$|E|$ = some integer $\times |V|$.

$|E| > |V|$ so it is a dense graph

Now,

~~Runtime = |V|~~

$$|E| = |V|^2/c$$

$$d = \frac{|V|^2}{c}/|V| = \frac{|V|}{c}$$

$$d = |V|/c$$

Now subbing d in

$|V| \times$ deletemin $+ (|V| + |E|) \times$ insert

which is

$$= O\left(\left(|V| \cdot \frac{d}{c} + |E|\right) \frac{\log |V|}{\log d}\right)$$

$$= O\left(\left(|V| \cdot \frac{|V|}{c} + |E|\right) \frac{\log |V|}{\log \frac{|V|}{c}}\right)$$

$$= O\left(\left(\frac{|V|^2}{c} + \frac{|V|^2}{c}\right) \frac{\log |V|}{\log |V| - \log c}\right)$$

$$= O\left(\left(\frac{|V|^2}{c} + \frac{|V|^2}{c}\right)\right) \frac{1}{\log c}$$

$$= O(|V|^2)$$