The Bellman-Ford algorithm we have seen in class is given below.

**Bellman-Ford**\( (G, w, s) \)

1. Initialize(\( G, s \))
2. for \( i \leftarrow 1 \) to \( |V[G]| - 1 \) do
3. \hspace{1em} for each edge \( (u,v) \in E[G] \) do
4. \hspace{2em} Relax\( (u,v,w) \)
5. \hspace{1em} for each edge \( (u,v) \in E[G] \) do
6. \hspace{2em} if \( d[v] > d[u] + w(u,v) \)
7. \hspace{2em} then return FALSE
8. return TRUE

(1) Apply the algorithm to the following graph. Use notation that will show how the labels of the vertices change during the application of the algorithm.

![Graph Diagram](attachment://graph.png)

(2) What value will the algorithm return for the graph in part 1?

TRUE/FALSE FALSE
Bellman-Ford($G,w,s$)
1 Initialize($G,s$)
2 for $i \leftarrow 1$ to $|V[G]|-1$ do
3 \hspace{1em} for each edge $(u,v) \in E[G]$ do
4 \hspace{2em} Relax($u,v,w$)
5 \hspace{1em} for each edge $(u,v) \in E[G]$ do
6 \hspace{2em} if $d[v] > d[u]+w(u,v)$
7 \hspace{3em} then return FALSE
8 return TRUE

(3) It was suggested to replace steps 5-8 of the algorithm with the following steps.

5 \hspace{1em} for each vertex $v \in V[G]$, assign $ne[v] = 0$.
6 \hspace{1em} for each edge $(u,v) \in E[G]$ do
7 \hspace{2em} if $d[v] > d[u]+w(u,v)$
8 \hspace{3em} then assign $ne[u] = ne[v] = 1$.

For each one of the following statements mark whether or not it is always correct.

(a) TRUE/FALSE If $ne[v] = 0$ then $v$ is on a negative cycle. FALSE
(b) TRUE/FALSE If $ne[v] = 0$ then $v$ is not on a negative cycle. FALSE
(c) TRUE/FALSE If $ne[v] = 1$ then $v$ is on a negative cycle. TRUE
(d) TRUE/FALSE If $ne[v] = 1$ then $v$ is not on a negative cycle. FALSE
The Bellman-Ford algorithm we have seen in class is given below.

Bellman-Ford\((G,w,s)\)

1. Initialize\((G,s)\)
2. for \(i \leftarrow 1\) to \(|V[G]| - 1\) do
3. for each edge \((u,v) \in E[G]\) do
4. Relax\((u,v,w)\)
5. for each edge \((u,v) \in E[G]\) do
6. if \(d[v] > d[u] + w(u,v)\) then return FALSE
7. return TRUE

1. Apply the algorithm to the following graph. Use notation that will show how the labels of the vertices change during the application of the algorithm.

2. What value will the algorithm return for the graph in part 1? TRUE/FALSE FALSE
Bellman-Ford($G,w,s$)
1 Initialize($G,s$)
2 for $i \leftarrow 1$ to $|V(G)|-1$ do
3 for each edge $(u,v) \in E(G)$ do
4 Relax($u,v,w$)
5 for each edge $(u,v) \in E(G)$ do
6 if $d[v] > d[u] + w(u,v)$
7 then return FALSE
8 return TRUE

(3) It was suggested to replace steps 5-8 of the algorithm with the following steps.

5 for each vertex $v \in V(G)$, assign $ne[v] = 2$.
6 for each edge $(u,v) \in E(G)$ do
7 if $d[v] > d[u] + w(u,v)$
8 then assign $ne[u] = ne[v] = 1$.

For each one of the following statements mark whether or not it is always correct.

(a) TRUE/FALSE If $ne[v] = 1$ then $v$ is on a negative cycle. TRUE
(b) TRUE/FALSE If $ne[v] = 1$ then $v$ is not on a negative cycle. FALSE
(c) TRUE/FALSE If $ne[v] = 2$ then $v$ is on a negative cycle. FALSE
(d) TRUE/FALSE If $ne[v] = 2$ then $v$ is not on a negative cycle. FALSE