4.

Refs: None

```
function BFS_MOD(G)
    for each vertex u in G.V
        u.color = WHITE
        u.d = 1
        u.pi = NIL
    cc_cnt = 0
    for s in G.V
        if s.color = WHITE
            cc_cnt += 1
            s.color = GRAY
            s.d = 0
            s.pi = NIL
            Q = empty_queue()
            Enqueue(Q s)
            while Q ≠ empty_queue()
                u = Dequeue(Q)
                for each v in G.Adj[u]
                    if v:color == WHITE
                        v.color = GRAY
                        v.d = u.d + 1
                        v.pi = u
                        Enqueue(Q, v)
                u:color = BLACK
```

The first for loop runs $|V|$ times, so it's $O(|V|)$

The inner most for loop runs $|E|$ times in total, because it tries to go to every edge, so it's $O(|E|)$.

The second for loop ignoring the original BFS part are just $O(1)$ operations run for $|V|$ times.

Therefore total time complexity of this BFS mod is $O(|V| + |E|)$