I hope this is helpful to anybody having trouble understanding computational time complexity for Breadth First Search a.k.a BFS.

67

```
Queue graphTraversal.add(firstVertex);

// This while loop will run V times, where V is total number of vertices in graph.
while(graphTraversal.isEmpty == false)

    currentVertex = graphTraversal.getVertex();

    // This while loop will run Eaj times, where Eaj is number of adjacent edges to
    while(currentVertex.hasAdjacentVertices)
        graphTraversal.add(adjacentVertex);

    graphTraversal.remove(currentVertex);
```

Time complexity is as follows:

```
V * (O(1) + O(Eaj) + O(1))
V + V * Eaj + V
2V + E(total number of edges in graph)
V + E
```

```
                    ┌─────────────────┐
                    │  Binary Number  │
                    │  Representation │
                    └─────────────────┘
                             │
    Only for                 │         For both Positive and
    Positive Numbers         │         Negative Numbers
           ┌─────────────────┴─────────────────┐
           ▼                                     ▼
   ┌─────────────┐                       ┌─────────────┐
   │  Unsigned   │                       │   Signed    │
   │Representation│                      │Representation│
   └─────────────┘                       └─────────────┘
                                                │
 Unambiguous                    ┌───────────────┼───────────────┐
 (only one 0)                   ▼               ▼               ▼
                        ┌─────────────┐ ┌─────────────┐ ┌─────────────┐
                        │Sign-Magnitude│ │1's complement│ │2's complement│
                        │    form     │ │    form     │ │    form     │
                        └─────────────┘ └─────────────┘ └─────────────┘

                        Ambiguous       Ambiguous       Unambiguous
                        (two 0's)       (two 0's)       (only one 0)
```

```
                    ┌─────────────────────┐
                    │   Binary Number     │
                    │   Representation    │
                    └─────────────────────┘
                               │
   Only for                   │          For both Positive and
   Positive Numbers           │          Negative Numbers
         ┌─────────────────────┴──────────────────────┐
         ▼                                             ▼
  ┌──────────────────┐                        ┌──────────────────┐
  │    Unsigned      │                        │     Signed        │
  │  Representation  │                        │  Representation   │
  └──────────────────┘                        └──────────────────┘
                                                        │
   Unambiguous                                          │
   (only one 0)                                         │
                          ┌──────────────────┬──────────┴──────────┐
                          ▼                  ▼                     ▼
                  ┌──────────────┐   ┌──────────────┐    ┌──────────────┐
                  │ Sign-Magnitude│   │ 1's complement│    │ 2's complement│
                  │     form      │   │     form      │    │     form      │
                  └──────────────┘   └──────────────┘    └──────────────┘

                   Ambiguous           Ambiguous            Unambiguous
                   (two 0's)           (two 0's)            (only one 0)
```