# Solution to Assignment:1

## Answer to Q3:

To find the maximum bandwidth of a path between two switching centers $a$ and $b$ in a telephone network graph, we can use a modified version of Dijkstra's algorithm. Here's the algorithm:

1. Initialize a priority queue $q$ and a distance array $d$ to store the maximum bandwidth values for each vertex.
2. Set all distances in $d$ to negative infinity, except for $a$, which is set to positive infinity.
3. Enqueue $a$ into $q$ with a priority of positive infinity.
4. While $q$ is not empty, do the following:
    - Dequeue a vertex $v$ from $q$.
    - For each neighbour $n$ of $v$, do the following:
        - Let $bw$ be the bandwidth of the edge between $v$ and $n$.
        - Let $max$ be the maximum bandwidth value between $v$ and $n$.
        - If $max$ is greater than the maximum bandwidth value recorded for $n$, update $n$'s maximum bandwidth value in $d$ and enqueue $n$ into $q$ with a priority of $max$.
5. Return the maximum bandwidth value recorded for $b$ in $d$**.**

## Answer to Q4:

The Floyd-Warshall algorithm can be used. Here is an algorithm for calculating the transitive reduction:

1. Initialize a matrix $R$ of size $n \times n$, where $n$ is the number of vertices in the graph. Set all elements of $R$ to 0 initially.
2. For each edge ($u$, $v$) in the graph, set $R[u][v]$ to 1.
3. For each vertex $k$ from 1 to $n$, do the following:
    a. For each pair of vertices $u$ and $v$, if $u$ is not equal to $k$ and $v$ is not equal to $k$, check if $R[u][k]$ and $R[k][v]$ are both 1.
    b. If both $R[u][k]$ and $R[k][v]$ are 1, then there is a path from $u$ to $v$ through $k$. In this case, set $R[u][v]$ to 0.
4. Return the resulting matrix $R$ as the transitive reduction of the graph.

The time complexity of this algorithm is O($n$^3), where $n$ is the number of vertices in the graph. The algorithm iterates through all possible vertex pairs and checks if there is a transitive edge through each intermediate vertex. The Floyd-Warshall algorithm efficiently computes the transitive closure of a graph, which can be used to derive the transitive reduction.