Now merge G_1 and G_2 to get G

Then Minimum Spanning Tree is

$$\begin{array}{ccccccc} A & \overset{10}{-} & B & \overset{1}{-} & C & \overset{10}{-} & D \\ {\scriptstyle 10}| & & & & & & |{\scriptstyle 10} \\ E & \underset{10}{-} & F & & G & \underset{10}{-} & H \end{array}$$

Cost = 61

However, this is not minimum spanning tree

Minimum spanning tree of G is

$$\begin{array}{ccccccc} A & \overset{10}{-} & B & \overset{1}{-} & C & \overset{10}{-} & D \\ {\scriptstyle 10}| & & & & & & \\ E & \underset{10}{-} & F & \underset{2}{-} & G & \underset{10}{-} & H \end{array}$$

Cost = 53

Thus, this algorithm fails

2. RANDOMIZED QUICKSORT

In the worst case, randomly picked pivots are always the smallest / largest. Thus each subsequence has size $n-1$.
Since the array is of size n, worst case has $\Theta(n^2)$

In the best case, randomly picked pivots are always median of the sequence. Thus, each subs-equence has size $\leq n/2$
Since the array is of size n, best case has $\Theta(n \log n)$.

3. $A[1 \ldots n]$ - array of n distinct numbers
$i < j$ and $A[i] > A[j] \Rightarrow (i, j)$ is inversion of A
Elements of A form uniform random permutation of $\langle 1, 2, \ldots, n \rangle$

Let X_{ij} be indicator random variable for event that $A[i] > A[j]$ for $i < j$.

Then we have $P[X_{ij} = 1] = \frac{1}{2}$ because given two distinct random numbers, probability that first is greater than the second is $1/2$

$E[X_{ij}] = 1/2$

$$X = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} X_{ij}$$