1. (a) $U(n)$ is an unbalanced sort. $B(N)$ is a balanced sort.

   Worst case scenario for a balanced sort would be $B(n) = U(\frac{n}{c}) + U(n - \frac{n}{c}) + dn$.
   Worst case scenario for an unbalanced sort is $U(n) = B(n - u) + udn$.

   If we subsitute, we are left with the expression

   $B(n) = B(\frac{n}{c} - u) + ud\frac{n}{c} + B(\frac{cn-n}{c} - u) + ud\frac{cn-n}{c} + dn$

   we can bring together all of the constant terms to

   $B(n) = B(\frac{n}{c} - u) + B(\frac{cn-n}{c} - u) + (\frac{n}{c} + \frac{cn-n}{c} + 1)ud$

   Consolidating the constants gets us

   $B(n) = B(\frac{n}{c} - u) + B(\frac{cn-n}{c} - u) + dun + du$

   $B(n) \leq 2B(\frac{n}{c}) + dun + du$

   The runtime of this is $O(n \log n)$

   (b) If $du = n$ at any point of this Quicksort, quicksort is actually root dominated, and the runtime becomes $O(n^2)$.