

family name _____ given name _____ ID _____

quiz2 2013oct25 c204

10marks 30min

no electronic devices

1. (i) Mergesort runs on a list with 1000 elements. Estimate, as an exact integer, the number of key comparisons.

(ii) Repeat for quicksort, assuming the pivot is always the smallest element of the sublist being partitioned.

2. `def getnum(n):`
 `trials = 0`
 `while True:`
 `t, trials = random.randint(n/2,n), trials+1`
 `if 1==pow(2,t-1,t): return t, trials`

Let $n = 2^{100}$. (i) Give a bound on the probability that `t` is prime. Justify briefly.

(ii) Estimate the average value of `trials`. Justify briefly.

(iii) Suggest an improvement to `getnum` that increases the probability that `t` is prime.

3. Let $T(n) = n$ for $n \leq 3$. Let $T(n) = 9T(n/3) + \Theta(n^2)$ for $n \geq 4$. Give a simple function $q(n)$ so that $T(n) = \Theta(q(n))$. Justify briefly.

4. *Zsort* implements mergesort, but takes $f(n)$ key comparisons to merge n elements. In O notation, give the number of key comparisons to **Zsort** an n -element list if

(i) $f(n) = 1000n$

(ii) $f(n) = 3n^{1.5}$

5. A:F B:C,D C:B,D,E,G D:B,C,G E:C F:A G:C,D

For this graph, list the vertices

(i) in preorder

(ii) in postorder