1 a

```
quicksort(A[n]):
    if(|A| = 1):
        return A
    x := rand(n)
    while(|B| < n/4 or |C| < n/4):
        partition(A) =: (B, a, C)
    A := (quicksort(B), a, quicksort(C))
    return A
```

2 b

If

$$\mathsf{X} \propto \text{Geom}(\frac{1}{2})$$

$$\mathbb{E}[T(n)] = \mathbb{E}[O(n)\mathsf{X}] + \mathbb{E}[T(j-1)] + \mathbb{E}[T(n-j)]$$

$$\mathbb{E}[T(n)] = O(n)\mathbb{E}[\mathsf{X}] + \mathbb{E}[T(j-1)] + \mathbb{E}[T(n-j)]$$

$$\mathbb{E}[T(n)] = 2O(n) + \mathbb{E}[T(j-1)] + \mathbb{E}[T(n-j)]$$

$$\leq 2O(n) + T(1/4) + T(3/4)$$