1. a) We are looking for the expected value subtract '1' to get position

ie $E(T) = E\left(\sum_{i=1}^{\infty} I_i\right) - 1$ (from section 4.4 of ODS)

If we let 'p' be the unfair coin probability: ie $p < \frac{1}{2}$ or $p > \frac{1}{2}$

$$E[T] = \left(\sum_{i=1}^{\infty} 1-p^{i-1}\right) - 1$$
$$= 1 + 1-p^1 + 1-p^2 + \ldots$$
$$= \frac{1}{1-p} - 1$$

1. b) The expected height of the skiplist can be found using:

$$E(h) = E\left(\sum_{r=1}^{\infty} I_r\right) \quad \text{(from section 4.4 of ODS)}$$

$$= \sum_{r=1}^{\log_{\frac{1}{p}} n} 1 + \sum_{r=\log_{\frac{1}{p}} n + 1} E(I_r)$$

← This is the same as from part a some can simplify to

$$\leq \log_{\frac{1}{p}} n + \underbrace{\frac{1}{1-p}}_{\text{this is our expected value}}$$

$$= \log_{\frac{1}{p}} n + \frac{1}{1-p}$$

1c, The total nodes w/o sentinal can be calculated with the $E(T)_{(\text{expected val})} * n$. This makes sense as for every node in our list, it will have a height expected of $E(T)-1$.

$\therefore$ total nodes is $\frac{n+1}{1-p}$ ← we add a '1' to n to account for sentinel nodes

4, ~~N/A~~ by hashing seems to have bugs I couldn't solve on my own.