Exercise 3, Discrete Mathematics for Bioinformatics

Sascha Meiers, Martin Seeger

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3.1 Skip lists

a) x

3.2 "Sparse" skip list

a) x

3.3 Skip lists

a) x

3.4 Independencies

We have

$$E(X_1) = \frac{1}{9}(1+1+2+2+3+3+1+2+3) = 2,$$
$$E(X_2) = \frac{1}{9}(2+3+1+3+1+2+1+2+3) = 2,$$
$$E(X_3) = \frac{1}{9}(3+2+3+1+2+1+1+2+3) = 2.$$

i) x

ii) x

iii) x

iv) x

v) x

vi) $N = X_2$, $E(N) = 2$. Therefore,

$$\sum_{i=1}^{E(N)} E(X_i) = E(X_1) + E(X_2) = 4.$$

On the other hand,

$$\begin{aligned} E\left(\sum_{i=1}^{N} X_i\right) &= P(N=1)E\left(\sum_{i=1}^{1} X_i \middle| N=1\right) + P(N=2)E\left(\sum_{i=1}^{2} X_i \middle| N=2\right) + \\ &+ P(N=3)E\left(\sum_{i=1}^{3} X_i \middle| N=3\right) = \frac{2}{3} + \frac{2+2}{3} + \frac{2+2+3}{3} = \frac{13}{3}. \end{aligned}$$