Submission for Apoorv Walia and Marco Lages

A3 3.1

Since log is concave, we can say

$$H(S) = H\left(\frac{p}{p+n}\right) = \frac{p}{p+n}\log_2\left(\frac{p+n}{p}\right) + \frac{n}{p+n}\log_2\left(\frac{p+n}{n}\right)$$

$$\leq \log_2\left(\frac{p}{p+n}\cdot\frac{p+n}{p} + \frac{n}{p+n}\cdot\frac{p+n}{n}\right) = \log(2) = 1$$

when $n = p$,

$$H(S) = \frac{1}{2}\log(2) + \frac{1}{2}\log(2) = 1$$