

3) (10 pts) ANL (Summations)

What is the closed form of the following summation? Your solution should be a function in terms of n . For full credit work must be shown.

$$\sum_{i=0}^n \sum_{j=0}^i 2^j$$

$$\sum_{i=0}^n \sum_{j=0}^i 2^j = \sum_{i=0}^n (2^{i+1} - 1)$$

$$= \sum_{i=0}^n 2^{i+1} - \sum_{i=0}^n 1$$

$$= \sum_{i=0}^n (2)2^i - (n+1)$$

$$= 2 \sum_{i=0}^n 2^i - (n+1)$$

$$= 2(2^{n+1} - 1) - (n+1)$$

$$= 2^{n+2} - 2 - n - 1$$

$$= 2^{n+2} - n - 3$$

Grading: 3 pts inner sum

1 pt split

1 pt second sum

4 pts first sum (lots of ways to break this down)

1 pt simplification at the end