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1. Show that  $\sum_{i=1}^n (i+1)2^i = n2^{n+1}$  for all positive integers  $n$ .

2. Let  $n$  be a positive integer and  $A_1, \dots, A_n$  be some sets. Let us define union of these sets as follows:

1.  $\cup_{i=1}^1 A_i = A_1,$

2.  $\cup_{i=1}^{k+1} A_i = (\cup_{i=1}^k A_i) \cup A_{k+1}.$

Show that  $\cup_{i=1}^n [i] = [n].$

3. (10 points) Let  $\Omega$  be some set. Consider  $A_1, \dots, A_n \subseteq \Omega$ . Show that  $\cup_{i=1}^n A_i = \{x \in \Omega : \exists i \in [n] \ x \in A_i\}$ .