Introduction to Discrete Mathematics (EIDMA)

sample combinatorial problems

1. Let X be the set of all different eight-letter words that can be obtained by permuting the letters of the word DEBUNKED.
   How many elements does X contain? .....
   In how many of them there are neighbouring identical letters? .....
   In how many elements of X there are no neighbouring vowels (terminology: E,U are vowel letters, while B,D,K,N are consonant letters)? .....

2. Assume that a basketball line-up must consist of 5 players: 2 guards, 1 center and 2 forwards. A coach has in total 12 players in the team: there are 5 guards, 2 centers, 4 forwards, and additionally Peter Williams, who can play as center or forward. How many 5-player subsets of this 12-element set are acceptable line-ups? .....
   In how many of them does Peter Williams appear? .....

3. In how many ways can we put 20 identical silver coins into five coloured boxes so that at most 3 coins go into the blue box, at least 4 into red and at most 5 into green? The remaining boxes are yellow and black and may contain any number of coins. Every box except the red one may also remain empty. .....

4. How many solutions of the equation $a+b+c+d=80$ in integers greater than 0 satisfy simultaneously all the following conditions:
   $a \leqslant 30, 10 \leqslant c \leqslant 40$ and a, b, c, d are all even? .....

   Remark: If your answer is eg. $\binom{7}{3} \cdot 5^6$, you don't have to compute the numerical answer 546875. Just write $\binom{7}{3} \cdot 5^6$ as the final answer.