CSCA67 Exer

① CACG does not end with T, it must appear at the end
There are 12 positions to consider
1st way: Place 2 T first, followed by 3 ATs . then ≥AGcTs.
  1AGT, 1 GGT, 1AGACAT, 1 AAGAT, 1 AGGCT.
  $c(12,2) \cdot c(10,3) \cdot c(7,2) \cdot c(5,1) \cdot c(4,1) \cdot c(3,1) \cdot c(2,1) \cdot c(1,1)$
    $= 19958400$

2nd way: Place 3 ATs, followed by ≥ AGCTs, ≥Ts.
  1AGT, 1 GGT, 1AGACAT, 1AAGAT, 1AGGCT.
  $c(12,3) \cdot c(9,2) \cdot c(7,2) \cdot c(5,1) \cdot c(4,1) \cdot c(3,1) \cdot c(2,1) \cdot c(1,1)$
    $= 19958400$

3rd way) Place ≥AGCTs, followed by ≥ Ts, 3 ATs.
  1AGT, 1GGT, 1AGACAT, 1 AAGAT, 1AGGCT
  $c(12,2) \cdot c(10,2) \cdot c(8,3) \cdot c(5,1) \cdot c(4,1) \cdot c(3,1) \cdot c(2,1) \cdot c(1,1)$
    $= 19958400$

The counts are equivalent.
There are $\frac{8!}{2!5!} = 168$ ways.

② A1 : Liberals $A_1 + A_2 + A_3 + A_4 = 24$
   A2 : Conservatives
   A3 : New Democrat   ↓ at least 7 A1, 2 A2, 1 A3, 1 A4
   A4 : Green
                         $A_1 + A_2 + A_3 + A_4 = 13$

   $\binom{13+4-1}{13} = 560$ ways.

③. 24 donuts.

x_i will be the variety for each i $1 \leq i \leq 6$.

$$x_1 + x_2 + \cdots + x_6 = 24$$

↓ at least one

$$x_1 + x_2 + \cdots + x_6 = 18$$

$$\binom{18+6-1}{18} = 33649 \text{ ways.}$$

④ A_1: apple $A_1 + A_2 + A_3 + A_4 = 10$

A_2: orange

A_3: pears   ↓ at leas $2 A_2, 1 A_1$

A_4: bananas

$$A_1 + A_2 + A_3 + A_4 = 7.$$

$$\binom{7+4-1}{7} = 120 \text{ ways.}$$