

1. How many permutations of the letters A,B,C,D,E,F,G are there in which the letters ABD appear consecutively, in alphabetical order?

ABD

4	3	2	1
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 $\leftarrow 4!$ of these

4

 ABD

3	2	1
---	---	---

 $\leftarrow 4!$ of these

4	3
---	---

 ABD

2	1
---	---

 $\leftarrow 4!$ of these

4	3	2
---	---	---

 ABD

1

 $\leftarrow 4!$ of these

4	3	2	1
---	---	---	---

 ABD $\leftarrow 4!$ of these

Answer $5 \cdot 4! = 5 \cdot 24 = \boxed{120}$

2. How many 10-digit binary strings are there that do not have exactly four 1's?
Show and explain your work fully.

All together there are 2^{10} 10-digit binary strings. Of these, $\binom{10}{4}$ have exactly four 1's.

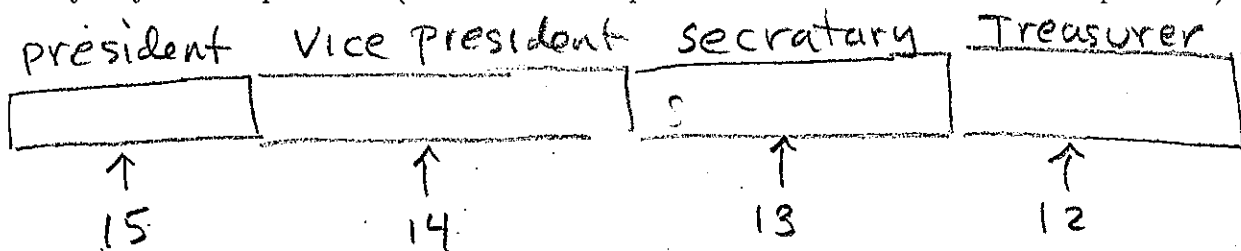
By the subtraction principle, our answer is

$$2^{10} - \binom{10}{4} = 1024 - \frac{10!}{4!6!} = 1024 - \frac{10 \cdot 9 \cdot 8 \cdot 7}{4 \cdot 3 \cdot 2}$$

$$= 1024 - 210 = \boxed{814 \text{ strings}}$$



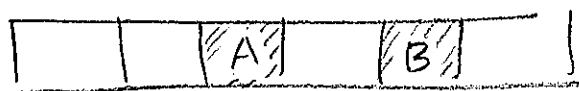
1. In a club of 15 people, a president, vice-president, secretary and treasurer must be chosen. In how many ways is this possible? (Assume that no person can serve in more than one position.)



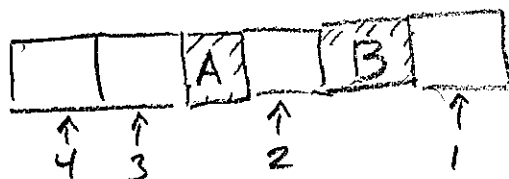
Ans $P(15, 4) = 15 \cdot 14 \cdot 13 \cdot 12$
 $= \boxed{32,760 \text{ ways}}$

2. This problem concerns lists of length 6 made from the letters A, B, C, D, E, F , without repetition. How many such lists are there for which the D occurs before the A ? Show and explain your work.

First select 2 positions from 6 for the A and B . Fill in the A first and B second.



There are $\binom{6}{2} = 15$ ways to do this.



Next there are $4!$ ways to fill in the other spots.

Ans $\binom{6}{2} 4! = \frac{6!}{2!4!} 4! = \frac{6!}{2} = \frac{720}{2} = \boxed{360}$