1(a) distinct balls (candy), distinct cells (children), no empty cells.

$5!\ S(12,5)$

(b) distinct balls (pencils), indistinct cells (shoebox), no empty cells.

$S(12,5)$

(c) distinct balls (teddy bears), distinct cells (location), empty cells possible.

5^{12}

(d) indistinct balls (pencils), indistinct cells (shoeboxes), no empty cells.

The number of partitions of 12 into 5 parts.

(e) distinct balls (teddy bears), indistinct cells (boxes), empty cells possible

$S(12,1) + S(12,2) + S(12,3) + S(12,4) + S(12,5)$

(f) indistinct balls (candy), distinct cells (children), no empty cells

$$\binom{12-1}{5-1} = \binom{11}{4}$$

(g) indistinct balls (robots), indistinct cells (boxes), empty cells possible

The number of partitions of 12 into 5 or fewer parts.

(h) indistinct balls (robots), distinct cells (locations), empty cells possible.

$$\binom{12+5-1}{12} = \binom{16}{12} \quad \left\{ \text{or } \binom{16}{4} \right\}$$

2(a) $12!$ (b) $\binom{12}{4,4,4} = \frac{12!}{4!\,4!\,4!}$

3(a) We need 5 R's and 4 U's hence
$\binom{9}{5,4} = \frac{9!}{5!\,4!}$

(b) We need 7 R's and 4 U's hence
$\binom{11}{7,4} = \frac{11!}{7!\,4!}$

(c) We split this into two cases:
The last step is an up; The last step is not an up.
- If the last step is an up, then all other ups are immediately followed by an R. Hence we want to distribute 3 UR's and 4 R's; giving $\binom{7}{3,4} = \frac{7!}{3!\,4!}$ ways.

If the last is not an up, then every up is immediatlly followed by an R. Hence we have 4 UR's and 3 R's; giving $\binom{7}{4,3} = \frac{7!}{4!\,3!}$

Hence there are $2\left(\frac{7!}{4!\,3!}\right)$ ways.

4(a) $\binom{13}{11} = \frac{13!}{11!\,2!}$

(b) $\binom{11}{8} 2^8 = \frac{11!}{8!\,3!} \cdot 2^8$

(c) $\binom{11}{4} = \binom{11}{7} = \binom{11}{4,7} = \frac{11!}{4!\,7!}$

(d) $\binom{12}{3,4,5} = \frac{12!}{3!\,4!\,5!}$

5 (a) 4A's 4C's 4G's 2U's $\therefore \binom{14}{4,4,4,2} = \frac{14!}{4!\,4!\,4!\,2!}$

(b) $\binom{4}{2,1,1} = \frac{4!}{2!\,1!\,1!}$

(c) {AG fragment must be last} 6!

(d) Since AG is end UCAG must be last G-fragment.
Since GC is a UC-fragment, CAUG is not first G-fragment.
This leaves two possibilities

ACGCAUGACGUCAG

ACGACGCAUGUCAG