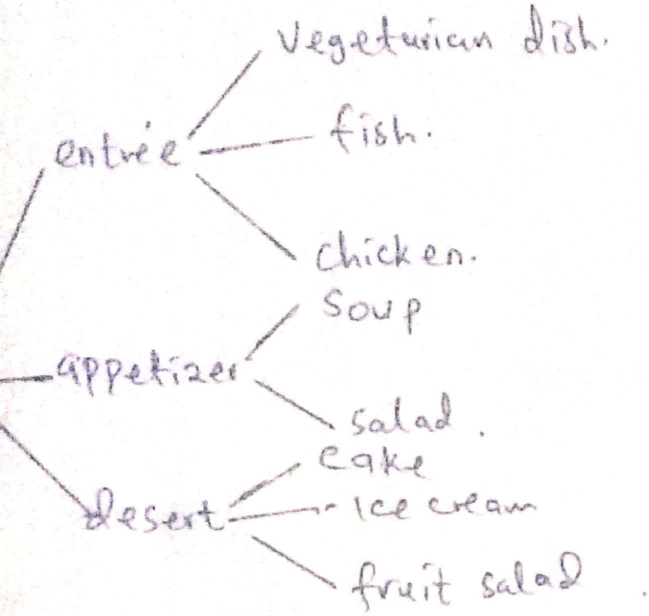
1



2. No of ways $8C3 = \frac{8!}{5!\,3!} = 56$ ways

3. $6! = 6\times5\times4\times3\times2\times1 = 720$ ways

4. Number of cars arranged
$= 4! = 4\times3\times2\times1$
$= 24$.
There are 2 heavy trucks
$\Rightarrow 24\times2$
$= 48$ ways

5. $2n = n!$
$2n = 1\times2\times\ldots\times n$
$2 = 1\times2\times\ldots\times(n-1)$
$2 = (n-1)!$
$0! = 1,\ 1! = 1,\ 2! = 2,\ 3! = 6.$
$4! = 24$
$\therefore$ 0, 1, 2, and 3

29
35
64
2
3

$$\frac{8\times7\times6\times\cancel{5\times4\times3\times2\times1}}{\cancel{5\times4\times3\times2}\times1\times3\times2\times1}$$

160

6. $5C3 = \frac{5!}{(5-3)!}$
$= \frac{5\times4\times3\times2\times1}{2\times1}$
$= 60$ orders.

7. $12P3 = \frac{12!}{(12-3)!}$
$= \frac{12\times11\times10\times9!}{9!}$
$= 12\times11\times10$
$= 1320$ ways.

8. There are 10 different ways
No. of arrangements $= 10!$
There are 4 2s, 3 3s, 3 7s
$\Rightarrow \frac{10!}{4!\times3!\times3!} = \frac{10\times9\times8\times7\times\cancel{6\times5\times4}!}{\cancel{4}!\times\cancel{2\times2}\times1\times3\times2\times1}$
$= 4200.$

9) a) No. of b's = 2   baseball

No. of a's = 2

No. of s's = 1

No. of e's = 1

No. of l's = 2

Total = 8

No. of permutations $= \dfrac{8!}{2!2!1!1!2!}$

$= \dfrac{8\times7\times6\times5\times\cancel{4}\times3\times\cancel{2}\times1}{\cancel{2}\times1\times\cancel{2}\times1\times1\times1\times\cancel{2}\times1}$

$= 5{,}040$

b) Set letter a as the first

∴ letters left = 7

∴ Pairs of identical letters = 2

∴ permutation $= \dfrac{7!}{2!2!}$

$= \dfrac{7\times6\times5\times\cancel{4}\times3\times\cancel{2}\times1}{2\times\cancel{1}\times\cancel{2}\times1}$

$= 1260.$

c) Set e at the end

∴ letters left = 7

Pairs of identical letters = 3.

Permutation $= \dfrac{7!}{2!2!2!}$

$= 530.$

10. No. of ways to arrange white tiles in 16 spaces

$= {}^{16}C_8 = \dfrac{16!}{8!8!}$

$= \dfrac{16\times15\times14\times13\times12\times11\times10\times9\times\cancel{8!}}{\cancel{8!}\times8\times7\times6\times5\times4\times3\times2\times1}$

$= 12870$

With 8 remaining spaces there are ${}^{8}C_4$ ways to arrange 4 grey tiles

${}^{8}C_4 = \dfrac{8!}{4!4!} = \dfrac{8\times7\times6\times5\times\cancel{4!}}{\cancel{4!}\times4\times\cancel{3}\times\cancel{2}\times1}$

$= 70$

No. of ways to rearrange blue tiles

${}^{4}C_4 = \dfrac{4!}{4!0!} = 1$

Total $= {}^{16}C_8 \times {}^{8}C_4 \times {}^{4}C_4.$

$= 12870 \times 70 \times 1$

$= 900{,}900$ patterns.

11.

$$
\begin{array}{ccccccccccc}
 & & & & & 1 & & & & & \\
 & & & & 1 & & 1 & & & & \\
 & & & 1 & & 2 & & 1 & & & \\
 & & 1 & & 3 & & 3 & & 1 & & \\
 & 1 & & 4 & & 6 & & 4 & & 1 & \\
1 & & 5 & & 10 & & 10 & & 5 & & 1
\end{array}
$$

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

6 15 20 15 6 1

7 21 35. 35 21 7 1

Sum 1+7+21+35+35+21+7+1

= 128.

3.

a) <u>Sierpinski triangle.</u>

- Is a fractal attractive fixed set with the overal shape of an equilateral triangle, subdivided recursively into smaller equilateral triangles.

b) <u>Diagonal pattern</u>

- Diagonals going along the left and right edges contain only 1's.
- Diagonals next to the edge diagonals contain the natural numbers in order
- Inwards, the next pair of diagonals contain triangular numbers in order

c) <u>Horizontal sum</u>

The sum of entries in the nth row is 2n.

14. Pascals method for generating coefficients of binomial expressions is concidered an iterative process due to the fact that each level of values in the pascal's series depends on the previous values, by getting the sum of the last digits. This makes the process iterative.

15.

S

| |

E E E

R R

P P P

I I I I

N N N

S S S S

K K K

I I

SIERPINSKI

1

1 1

1 2 1

1 3 3 1

4 6 4 1

5 10 10 5

15 20 15

35 35

S

1 1

E 2 E E

3 R 3 R

P 6 P P

I 7 I 7 I I

8 N 14 N 8 N

S 22 S 22 S S

23 K 44 23 K

67 I 67 I

134

= 134 ways.