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# Circuit Graph Theory Formulas

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# List of 15 Circuit Graph Theory Formulas

## Circuit Graph Theory

### 1) Average Degree

$$fx \quad k = p \cdot N$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$ex \quad 4.5 = 0.75 \cdot 6$$

### 2) Average Path Length between Connected Nodes

$$fx \quad L_{Path} = \frac{\ln(N)}{\ln(k)}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$ex \quad 1.191268 = \frac{\ln(6)}{\ln(4.5)}$$

### 3) Maximum Number of Edges in Bipartite Graph

$$fx \quad b_b = \frac{N^2}{4}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$ex \quad 9 = \frac{(6)^2}{4}$$



#### 4) Number of Branches in any Graph

$$fx \quad b = L + N - 1$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

$$ex \quad 8 = 3 + 6 - 1$$

#### 5) Number of Branches in Complete Graph

$$fx \quad b_c = \frac{N \cdot (N - 1)}{2}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

$$ex \quad 15 = \frac{6 \cdot (6 - 1)}{2}$$

#### 6) Number of Branches in Forest Graph

$$fx \quad b_f = N - N_{comp}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

$$ex \quad 4 = 6 - 2$$

#### 7) Number of Branches in Wheel Graph

$$fx \quad b_w = 2 \cdot (N - 1)$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754\_img.jpg\)](#)

$$ex \quad 10 = 2 \cdot (6 - 1)$$

#### 8) Number of Graphs given Nodes

$$fx \quad N_{graph} = 2^{N \cdot \frac{N-1}{2}}$$

[Open Calculator !\[\]\(aff7c69c44a5e015f18c35867ef3f5c3\_img.jpg\)](#)

$$ex \quad 32768 = 2^{6 \cdot \frac{6-1}{2}}$$



### 9) Number of Links in any Graph

$$fx \quad L = b - N + 1$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

$$ex \quad 3 = 8 - 6 + 1$$

### 10) Number of Maxterms and Minterms

$$fx \quad N_{\tau} = (2^n)$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$ex \quad 2048 = (2^{11})$$

### 11) Number of Nodes in any Graph

$$fx \quad N = b - L + 1$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$ex \quad 6 = 8 - 3 + 1$$

### 12) Rank for Incidence Matrix using Probability

$$fx \quad \rho = N - p$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b\_img.jpg\)](#)

$$ex \quad 5 = 6 - 0.75$$

### 13) Rank of Cutset Matrix

$$fx \quad \rho = N - 1$$

[Open Calculator !\[\]\(40770d9ed6ed4f1222ebf89a1396e8b2\_img.jpg\)](#)

$$ex \quad 5 = 6 - 1$$



## 14) Rank of Incidence Matrix

$$\text{fx } \rho = N - 1$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a\_img.jpg\)](#)

$$\text{ex } 5 = 6 - 1$$

## 15) Spanning Tress in Complete Graph

$$\text{fx } N_{\text{span}} = N^{N-2}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021\_img.jpg\)](#)

$$\text{ex } 1296 = (6)^{(6)-2}$$



## Variables Used

- **b** Simple Graph Branches
- **b<sub>b</sub>** Bipartite Graph Branches
- **b<sub>c</sub>** Complete Graph Branches
- **b<sub>f</sub>** Forest Graph Branches
- **b<sub>w</sub>** Wheel Graph Branches
- **k** Average Degree
- **L** Simple Graph Links
- **L<sub>Path</sub>** Average Path Length
- **n** Number of Input Variables
- **N** Nodes
- **N<sub>comp</sub>** Forest Graph Components
- **N<sub>graph</sub>** Number of Graph
- **N<sub>span</sub>** Spanning Trees
- **N<sub>T</sub>** Total Minterms/ Maxterms
- **p** Probability
- **ρ** Matrix Rank



## Constants, Functions, Measurements used

- **Function:**  $\ln$ ,  $\ln(\text{Number})$   
*Natural logarithm function (base  $e$ )*



## Check other formula lists

- **Circuit Graph Theory Formulas** 

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