

**Section 1.6**  
**Fundamental Counting**

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**THE PIGEON HOLE PRINCIPLE**

**Theorem 1.6.1 (The Pigeon Hole Principle):** If  $m$  pigeons are placed in  $k$  pigeon holes, then one hole will contain at least  $\lceil \frac{m}{k} \rceil$  pigeons.

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**GRAPHS ON SIX VERTICES**

**Theorem 1.6.2:** Any graph on six vertices contains an induced  $K_3$  or an induced  $\bar{K}_3$  as a subgraph.

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**NUMBER OF LABELED GRAPHS ON  $p$   
VERTICES**

**Theorem 1.6.3:** If  $N = \binom{p}{2}$ , then there are  $2^N$  labeled graphs on  $p$  vertices.

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**NUMBER OF SUBGRAPHS OF  $K_n$   
ISOMORPHIC TO  $P_k$**

**Theorem 1.6.4:** The number of subgraphs of  $K_n$  isomorphic to  $P_k$  is

$$\frac{n!}{2(n-k)!}$$

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