Converse: $p \to q \Rightarrow q \to p$ **Inverse**: $p \to q \Rightarrow \neg p \to \neg q$ **Contrapositive**: $p \to q \Rightarrow \neg q \to \neg p \equiv p \to q$ **DeMorguns**: $\neg(p \wedge q) = \neg p \vee \neg q$ **Set Equality**: $A = B$ iff $A \subseteq B \wedge B \subseteq A$ **Subset**: $A \subseteq B$ if $x \in A \to x \in B$ **Proper Subsets**: $A \subseteq B \wedge A \neq B$ **Power Set** $|\mathcal{P}(A)| = 2^{|A|}$ **Set union**: combine both sets **Set Intersection**: Things in both sets **Disjoint Sets**: $A \cap B = \emptyset$ **Difference of sets**: A-B or A/B remove al elements of B in A. **Not for Sets**: $\overline{A}$ = all not in A. req: D.D. **DeMorgan Set**: $\overline{A \cup B} = \overline{A} \cap \overline{B}$ **Distro Laws** $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

1] Contradict $p \to q$
2] Suppose p and $\neg q$
3] Unpack Defenition
4] Prove false, but
5] WIN contra

1] Contrapos $p \to q$
2] Suppose $\neg q \equiv T$
4] Show $\neg p$ follows
5.1] $\neg p \to \neg q$
5] $p \to q$

PMI
1] PBPMI
2] Base Case
3] I.H.
4] see ex

Possible Subgraphs for K_n: $\sum_{k=1}^{n} 2^{\binom{k}{2}}$

1] PMI: $\forall n \geq 1$ $B \cap \left(\bigcup_{k=1}^{n} A_k\right) = \bigcup_{k=1}^{n} (B \cap A_k)$ // step 4: eval @n+1

2] B.C. n=1 $B \cap A_k = B \cap A_k$

3] IH: $B \cap \left(\bigcup_{k=1}^{n} A_k\right) = \bigcup_{k=1}^{n} (B \cap A_k)$

4] $B \cap \left(\bigcup_{k=1}^{n+1} A_k\right)$ // Pop off top

$= B \cap \left(\bigcup_{k=1}^{n} A_k \cup A_{n+1}\right)$ // Apply IH

$= \left(B \cap \bigcup_{k=1}^{n} A_k\right) \cup (B \cap A_{n+1})$

$= \left(\bigcup_{k=1}^{n} (B \cap A_k)\right) \cup (B \cap A_{n+1})$

$= \bigcup_{k=1}^{n+1} (B \cap A_k)$ 5] Boom

DJIKSTRA'S CORNER

```
1] Define all labels = $\infty$, and $L(a) = 0$
   and $S = \emptyset$                        $\Rightarrow L(z) =$ path len
2] while $z \notin S$
      $v$ = a vertex not in S with $L(v)$
        minimal
      $S := S \cup \{v\}$
      for all verticies not in S:
         Add a vertex to S with minimal
         label, and update Lbl's of
         verticies not in S
```

Arrange n distinct items: $n!$ **Arrange n with r repetition**: $n!/r!$ **Permutations**: $P(n,r)$ $\frac{n!}{(n-r)!}$, ordered. **Combination**: nchoose $k = \binom{n}{k} = \frac{n!}{k!(n-k)!}$, unordered. The number of subsets of length k formable. **Coefficients**: $\binom{P}{T}$ Power choose Term st. @ 0. **Pascal's Identity** $\binom{n+1}{k} = \binom{n}{k-1} + \binom{n}{k}$ **Multisets**: How many of length $= \binom{n+k-1}{k}$ **Graph**$=(V, E)$

select k from n distinct

ordered	unordered	[illegible]
n^k	$\binom{n+k-1}{k}$	Repeats not dist
$P(n,k$	$\binom{n}{k}$	Distinct no rep

1 pers only love self $\exists x \forall y L(x,y)$

Graph Types and Descriptions

Graph	Edges	Mult. E. allow	Loop
simple	UNDIR	N	N
multigr.	UNDIR	Y	N
pseudo gr	UNDIR	Y	Y
Sim. Dir	DIR	Y in diff dir	N
mul. dir	DIR	Y	Y
Mixte	*	*	*

Neighborhood: all verticies conn'd to vertex. Denoted $N(v)$. **$N(\text{set})$** $= \bigcup_{v \in A} [(A \text{ is set})]\, N(v)$ **Deg** number of edges leading into a vertex. **IN degree**: $\deg^-(v)$ **out dgree** $\deg^+(v)$ **Note**: $|E| = \sum \deg^-(v \in V) = \sum \deg^+(v \in V)$ **Complete Graph**: K_n, all verticies connected, $\sum_{k=0}^{n-1}$. **Cycle Graph**: n verticies, n edges. **Wheel**: put a vertex in center of C_n, connect to all verticies. **Handshake**: $\sum_{v \in V} \deg(v) = 2|E|$ **Bipartite**: color red/blu so no red touch red or same w/blu **Subgraph**: $G = (V, E)$, $S.G = (W, F) \mid F \subseteq E \wedge W \subseteq V$ **Induced**: only incl edges between selected subg such that only edges . . . . .

Adjacency Matrix: make matrix, and put 1 if line connects verticies.

Ring Permutations: $\frac{P(n,k)}{k}$. 4 people, 4 seats: $4!/4$ **Dijkstra**: 1] start at point, for all connected points, add weight to current point, put in box. Goto least valued point not already visited. rep till end. There is 1 pers every loves: $L(x,y) = xLy$: $\exists x(\forall y(L(\overset{y}{x},\overset{x}{y}))\wedge(\forall z(\forall w(\overset{z=w}{L(w,z)})$