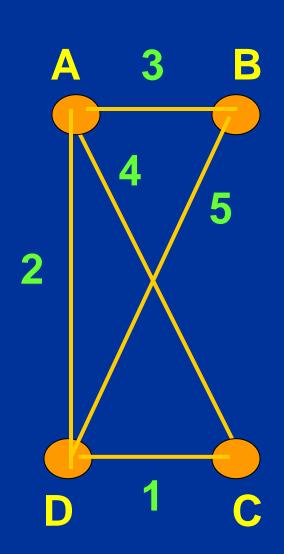
Warshall's algorithm (n vertices)

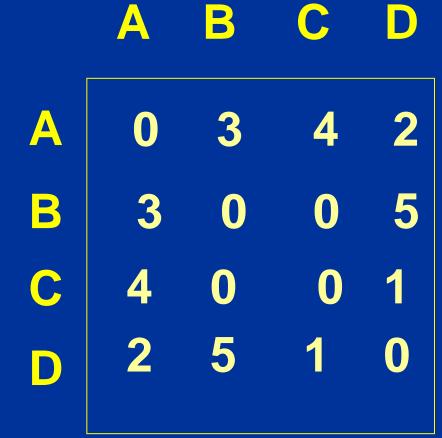
- Build matrix $\overline{W} = \{w_{ij}\}$:
 - $-\mathbf{w}_{ij}$: weight of edge $(\mathbf{v}_i, \mathbf{v}_j)$ ["0" if no edge]
- Build a sequence of matrices L₀, L₁,..., L_n
 - $-L_0$ = W, replacing off-diagonal "0" → "∞"
 - for k := 1 To n

$$L_k = \{l_k (i, j); i=1,...,n; j = 1,...,n\}$$

• $l_k(i, j) = min [l_{k-1}(i, j); l_{k-1}(i, k) + l_{k-1}(k, j)]$







| (LO) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|---------------|---------------|---------------|
| A-1 | O (AA) | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | O (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) |

| L1) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|---------------|---------------|---------------|
| A-1 | O (AA) | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) |
| | | | | |

| L1) | A-1 | B-2 | C-3 | D-4 |
|-----|------------------|---------------|------------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------|------------------|---------------|------------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) X | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------|------------------|---------------|------------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| L1) | A-1 | B-2 | C-3 | D-4 |
|-----|-------------------------------------|------------------|------------------|------------------|
| A-1 | (AA)(AA) | 3 (AB) 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| L1) | A-1 | B-2 | C-3 | D-4 |
|------------|------------------|------------------|---------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) | 1 (CD) |
| D-4 | | | 0 (cc) | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| $\left(L1\right)_{I}$ | A-1 | B-2 | C-3 | D-4 |
|-----------------------|------------------|------------------|------------------|---------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| $\left(L1\right)_{I}$ | A-1 | B-2 | C-3 | D-4 |
|-----------------------|-------------------------------------|------------------|------------------|------------------|
| A-1 | (AA)(AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------------|------------------|------------------|-------------------|---------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) X |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | O (DD) |
| | | | | O (DD) |

| $\left(L1\right) $ | A-1 | B-2 | C-3 | D-4 |
|---------------------|------------------|------------------|------------------|---------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) X |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) O (DD) |

| $\left(L1\right)_{I}$ | A-1 | B-2 | C-3 | D-4 |
|-----------------------|-------------------------------------|------------------|------------------|------------------|
| A-1 | (AA)(AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| $\left(L1\right)_{I}$ | A-1 | B-2 | C-3 | D-4 |
|-----------------------|------------------|------------------|------------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| $\left(L1 \right)_{I}$ | A-1 | B-2 | C-3 | D-4 |
|-------------------------|---------------|------------------|-------------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) O (DD) |

| $\left(L1 \right)_{I}$ | A-1 | B-2 | C-3 | D-4 |
|-------------------------|------------------|------------------|-------------------|------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) O (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------------|------------------|------------------|------------------|----------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) 7 (BAC) | 5 (BD) 5 (BD=BAD) |
| C-3 D-4 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 (CD) |
| J-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------------|------------------|------------------|-------------------|----------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) 7 (BAC) | 5 (BD) 5 (BD=BAD) |
| C-3 D-4 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 _(CD) |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------------|------------------|------------------|-------------------|----------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) 7 (BAC) | 5 (BD) 5 (BD=BAD) |
| C-3 D-4 | 4 (CA) | ∞ (CB) | 0 (cc) 0 (cc) | 1 _(CD) |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 (DD) 0 (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|------------|------------------|------------------|-------------------|----------------------|
| A-1 | 0 (AA) 0 (AA) | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 (BB) 0 (BB) | ∞ (BC) 7 (BAC) | 5 (BD) 5 (BD=BAD) |
| C-3 | 4 (CA) | ∞ (cB) | 0 (cc) 0 (cc) | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1(DC) | O (DD) O (DD) |

| (L1) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|----------------|----------------------|----------------------|
| A-1 | O (AA) | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 0 (AA) 3 (BA) | 3 (AB) 0 (BB) | 4 (AC) ∞ (BC) | 2 (AD) 5 (BD) |
| D- Z | 3 (BA) | O (BB) | 7 (BAC) | 5 (BD) 5 (BD=BAD) |
| C-3 | 4 (CA) | ∞ (CB) | 0 (cc) | 1 (CD) |
| D-4 | 4 (CA) | 7 (CAB) | 0 (cc) | 1 (CD) |
| | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) |
| | 2 (DA) | 5 (DB) | 1 (DC) | O (DD) |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|-------------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2) | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|----------------|-------------------|
| A-1 | 0 | 3 (AB) X | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) X | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | _ | | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|----------------|-------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|----------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | 2 (DA) | (DB) | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |
| | | | . (50) | 0 |

| L2) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) X |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 | 5 | 4 | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) X |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | | 0 | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 0 7 (CAB) | 0 | 1 (CD) |
| D-4 | T (CA) | I (CAB) | 0 | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C 2 | | 0 | X | |
| U-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | | U | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| A-I | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C 2 | | U | X | |
| U-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | | U | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| A-I | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | | 0 | 7 (BAC) | |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | | | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 0_ | 7 (BAC) | X |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | | | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| A-1 | B-2 | C-3 | D-4 |
|---------------|-----------------------|---|---|
| 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (AB) | 4 (AC) | 2 (AD) |
| 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | | (BAC) | |
| 4 (CA) | (CAB) | 0 | 1 (CD) |
| | _ | | |
| 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | A-1 0 0 3 (BA) 4 (CA) | О 3 (AB) О 3 (AB) 3 (BA) О 0 О 7 (CAB) | 0 3 (AB) 4 (AC) 0 3 (AB) 4 (AC) 3 (BA) 0 7 (BAC) 7 (BAC) 7 (BAC) 4 (CA) 7 (CAB) 0 0 0 |

| (L2) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------|-------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | | | 0 | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| (L2) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 0 | 7 (BAC) | 5 (BD) |
| D-4 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |
| | | | | 0 |

| (L2) | A-1 | B-2 | C-3 | D-4 |
|------|---------------|------------------|--------------------|-------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| (L2) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------|-------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | _ | | 1 _(CD) |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L2) | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|-------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 0 7 (CAB) | 7 (BAC) 0 | 5 (BD) 1(CD) |
| D-4 | | | 0 | 1 (CD) |
| | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |

| L2 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|---------------|
| L2 A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|---------------|
| L3 A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) X | 4 (AC) | 2 (AD) |
| | | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|----------------|----------------|-------------------|
| A-1 | 0 | 3 (AB) X | 4 (AC) | 2 (AD) |
| | | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|----------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|----------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) X |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) X |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| | 3 (BA) | 0 | 7 (вас) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|--------------------|-------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|--------------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|--------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | | 0 | 7 (BAC) 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| A-1 | B-2 | C-3 | D-4 |
|---------------|------------------|---|--|
| 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | 0 0 3 (BA) | О 3 (AB) О 3 (AB) 3 (BA) О 0 О 7 (CAB) | 0 3 (AB) 4 (AC) 0 3 (AB) 4 (AC) 3 (BA) 0 7 (BAC) 7 (CAB) 0 0 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 | 5 : | | |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L3) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|------------------|--------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L 3 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 4 (AC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 7 (BAC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1(CD) 1(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1(00) | n (CD) |
| | 2 (DA) | | 1 (DC) | 0 |

| L3 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |
| | | | | |

| L4 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | |

| (L4) | A-1 | B-2 | C-3 | D-4 |
|------|---------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) X | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | 5 (DB) | 1 _(DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|----------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) X | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | | 5 (DB) | 1 _(DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|----------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|----------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) X | 2 (AD) |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|--------------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) |
| | | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 _(DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|-------------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) X |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|----------------|---------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) X |
| | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|-------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|-------------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|----------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L4) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|------------------|-----------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 6 (BDC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

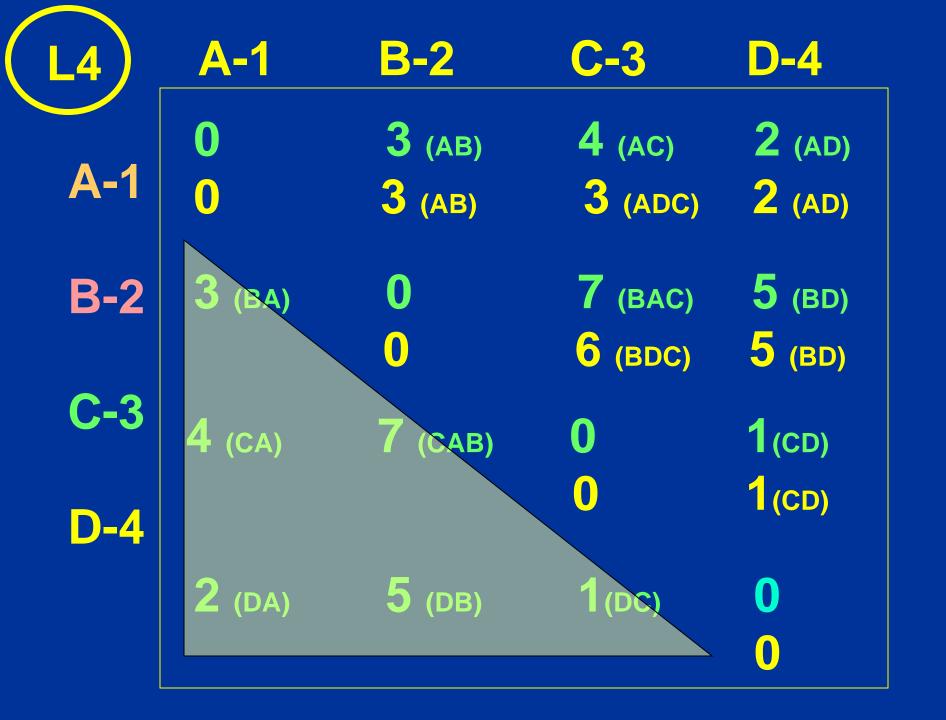
| L4) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|------------------|-----------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 6 (BDC) | 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|-----|---------------|------------------|-----------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 6 (BDC) | 5 (BD) |
| | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L4 | A-1 | B-2 | C-3 | D-4 |
|------------|---------------|------------------|-----------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 6 (BDC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |

| L4) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|------------------|-----------------|------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 6 (BDC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1(CD) |
| D-4 | | | | X |
| | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | 0 |

| L4) | A-1 | B-2 | C-3 | D-4 |
|-------------|---------------|------------------|-------------------|-------------------|
| A-1 | 0 | 3 (AB) 3 (AB) | 4 (AC) 3 (ADC) | 2 (AD) 2 (AD) |
| B-2 | 3 (BA) | 0 | 7 (BAC) 6 (BDC) | 5 (BD) 5 (BD) |
| C-3 | 4 (CA) | 7 (CAB) | 0 | 1 _(CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |



| L4 | A-1 | B-2 | C-3 | D-4 |
|------------|----------------|----------------|----------------|---------------|
| A-1 | 0 | 3 (AB) | 3 (ADC) | 2 (AD) |
| B-2 | 3 (BA) | 0 | 6 (BDC) | 5 (BD) |
| C-3 | 3 (CDA) | 6 (CDB) | 0 | 1 (CD) |
| D-4 | 2 (DA) | 5 (DB) | 1 (DC) | 0 |
| | | | | |