2.24

- Idea of the comparison with minimum congestion mapping: If an interconnection network A is mapped to a network B with a congestion *r* but network B is *r* times faster than A, then B is stricly superior than A (fewer links, at least same performance).
- The mapping of a hypercube on a mesh follows the inverse of the mesh on the hypercube. A sub-cube of $\sqrt{p}$ processors is mapped on each row of the mesh (assume a $\sqrt{p}*\sqrt{p}$ mesh). We count the number of hypercube links going from one half of the mesh (on a row) to the other half (see Fig. 2.33). Every node of one half has a link to another node on the other half. We have $\sqrt{p}/2$ links. The mesh has one link (no wrap-around). The congestion on a mesh without wrap-around is $\sqrt{p}/2$ and with wrap-around $\sqrt{p}/4$ (since we have 2 links connecting each half).
- We need to check the ratio $\sqrt{p}/2$ (or $\sqrt{p}/4$) to compare the hypercube with the mesh. $\sqrt{1024}/2=16$, $\sqrt{1024}/4=8$. The mesh is 25/2=12.5 times faster than the hypercube so a wrap-around mesh is strictly better (at least 8 times faster), not the mesh without wrap-around.

3.2

	(a)	(b)	(c)	(d)
Maximum degree of concurrency.	8	8	8	2
Critical path length.	4	4	7	8
Maximal speedup.	15/4	15/4	14/7	15/8
Minimum number of processes to achieve the maximum speedup.	8	8	3	2
Maximum speedup if the number of processes is limited to 2, 4, 8.	15/8, 3, 15/4	15/8, 3, 15/4	7/4, 2, 2	15/8, 15/8, 15/8

3.4

- Since any path from a start to a finish cannot be longer than *l*, there must be at least $\lceil t/l \rceil$ independent paths from start to finish to accommodate all *t* nodes. Hence *d* must be $\geq \lceil t/l \rceil$. If $d > t-l+1$, then it is impossible to have a critical path of length *l* or higher because $l-1$ more nodes are needed to construct this path. Hence $\lceil t/l \rceil \leq d \leq t-l+1$.

3.6, 3.7 & 3.8

- 3.6) Critical paths:
  - 1,2,6,10,11,13,14
  - 1,2,6,10,12,13,14
  - 1,4,6,10,11,13,14
  - 1,4,6,10,12,13,14
- 3.7 & 3.8) Argument for best mappings: The length of the mappings is the same as the critical path and we cannot do better.

3.7 & 3.8