1S2 (Timoney) Tutorial sheet 12

[February 11 – 15, 2008]

Name: Solutions

1. Write a vertex matrix for this directed graph



Solution: In row i we put a 1 in column j when there is a link $i \rightarrow j$. Otherwise 0. We get the 4×4 matrix

Γ	0	1	0	0]
	0	0	1	0
	1	0	0	1
	0	0	0	0

2. Draw a graph for this vertex matrix

$$M = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

and then use matrix multiplication to find all the possible 2-hop directed paths on the graph. *Solution:*



$$M^{2} = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

This shows the the 2-hop paths are $1 \rightarrow 5, 2 \rightarrow 3, 3 \rightarrow 4, 4 \rightarrow 2, 4 \rightarrow 3$ and $5 \rightarrow 1$, in addition to the possibility for round trips $1 \rightarrow 1$ and $2 \rightarrow 2$.

3. Fill in the numbers 1–4, 7, 8, 9, 15, 16 in octal, binary and hexadecimal. *Solution:*

Base 10	1	2	3	4	7	8	9	15	16
Octal	1	2	3	4	7	10	11	17	20
Binary	1	10	11	100	111	1000	1001	1111	10000
Hexadecimal	1	2	3	4	7	8	9	f	10

4. Fill in the numbers 24, 31, 32, 40 in octal and hexadecimal. *Solution:*

Base 10	24	31	32	40
Octal	30	37	40	50
Hexadecimal	18	lf	20	28

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