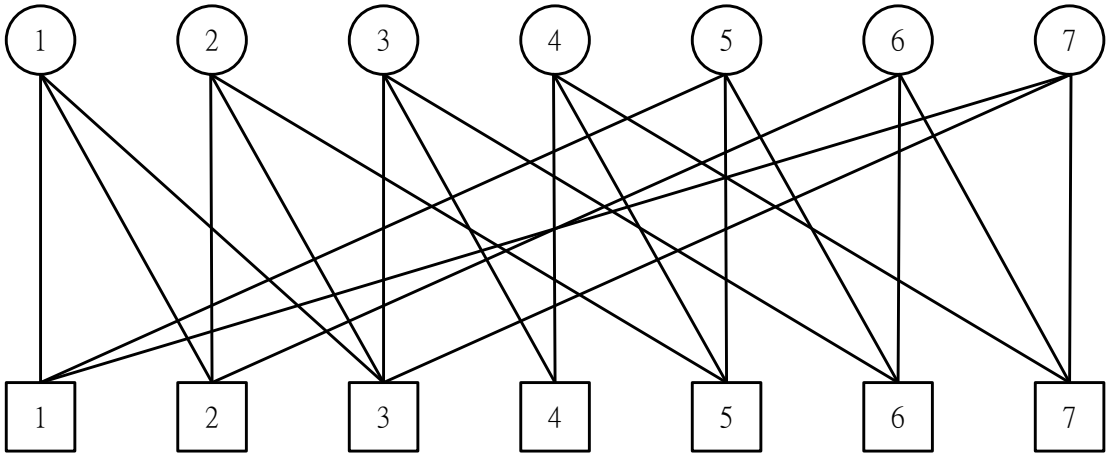
2008 Advanced Coding Theorem HW#2 solution

1. (a) $\because \begin{pmatrix}1\\0\\0\\0\\1\\0\\1\end{pmatrix}+\begin{pmatrix}1\\1\\0\\0\\0\\1\\0\end{pmatrix}+\begin{pmatrix}0\\1\\1\\0\\0\\0\\1\end{pmatrix}+\begin{pmatrix}0\\0\\1\\0\\1\\1\\0\end{pmatrix}=\begin{pmatrix}0\\0\\0\\0\\0\\0\\0\end{pmatrix}\therefore d_{\min}=4$

(b)



(c) No

$h_{11}\to h_{12}\to h_{62}\to h_{66}\to h_{56}\to h_{51}\to h_{11}$

$h_{11}\to h_{12}\to h_{22}\to h_{25}\to h_{55}\to h_{51}\to h_{11}$

$h_{11}\to h_{12}\to h_{62}\to h_{67}\to h_{77}\to h_{71}\to h_{11}$

(d) $h_{11}\to h_{14}\to h_{34}\to h_{33}\to h_{73}\to h_{71}\to h_{11}$

$h_{11}\to h_{14}\to h_{34}\to h_{36}\to h_{56}\to h_{51}\to h_{11}$

$h_{11}\to h_{14}\to h_{44}\to h_{45}\to h_{55}\to h_{51}\to h_{11}$

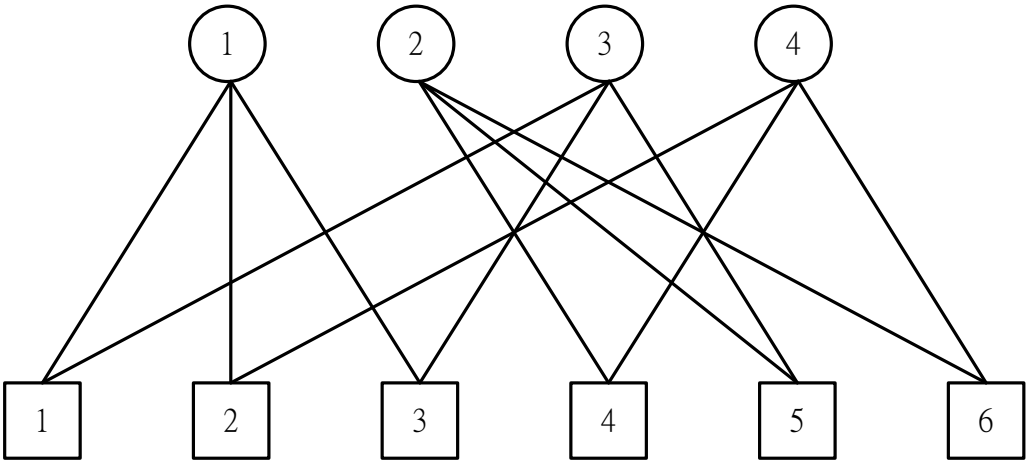
$h_{11}\to h_{14}\to h_{44}\to h_{47}\to h_{77}\to h_{71}\to h_{11}$

There are 7 branch starting from and back to h_{11}.

Because *i*th row in H is shift by (*i*-1)th. We can know total number of cycle 6 is

7*7=49

2.



$$\mu_{C\to V_1}^{(1)} = \mu_{V_1}^{(0)} + 1og\left[\frac{1+\tanh(\frac{\mu_{V_2}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_3}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_2}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_3}^{(0)}}{2})}\right] + 1og\left[\frac{1+\tanh(\frac{\mu_{V_3}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_5}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_3}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_5}^{(0)}}{2})}\right] = 1.115996$$

$$\mu_{C\to V_2}^{(1)} = \mu_{2}^{(0)} + 1og\left[\frac{1+\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_3}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_3}^{(0)}}{2})}\right] + 1og\left[\frac{1+\tanh(\frac{\mu_{V_4}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_4}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}\right] = -0.74657$$

$$\mu_{C\to V_3}^{(1)} = \mu_{3}^{(0)} + 1og\left[\frac{1+\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_2}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_2}^{(0)}}{2})}\right] + 1og\left[\frac{1+\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_5}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_5}^{(0)}}{2})}\right] = -0.88077$$

$$\mu_{C\to V_4}^{(0)} = \mu_{4}^{(0)} + 1og\left[\frac{1+\tanh(\frac{\mu_{V_5}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_5}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}\right] + 1og\left[\frac{1+\tanh(\frac{\mu_{V_3}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_3}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}\right] = 0.165159$$

$$\mu_{C\to V_5}^{(1)} = \mu_{V_5}^{(0)} + 1og\left[\frac{1+\tanh(\frac{\mu_{V_4}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_4}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_6}^{(0)}}{2})}\right] + 1og\left[\frac{1+\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_3}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_1}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_3}^{(0)}}{2})}\right] = -0.94657$$

$$\mu_{C\to V_6}^{(1)} = \mu_{V_6}^{(0)} + 1og\left[\frac{1+\tanh(\frac{\mu_{V_4}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_5}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_4}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_5}^{(0)}}{2})}\right] + 1og\left[\frac{1+\tanh(\frac{\mu_{V_2}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_4}^{(0)}}{2})}{1-\tanh(\frac{\mu_{V_2}^{(0)}}{2})\cdot\tanh(\frac{\mu_{V_4}^{(0)}}{2})}\right] = -0.216$$

Do hard decision and check c$\mathbf{H}^t$ is zero or not.

Because c$\mathbf{H}^t$ is zero => finish.

Hard decision: {0,1,1,0,1,1}