HW4

1. Ans

   (a) Since each node has a dedicated channel to every other node, $H_{avg} = 1$

   $T_{rmin} = H_{avg}T_r = 15ns$

   $T_s = \frac{L}{d} = 31.25ns$

   As $T_w = 0$

   $T_0 = H_{avg}T_{rmin} + T_s = 46.25ns$

   (b) $T_{rmin} = H_{avg}T_r = 240ns$

   $T_s = \frac{L}{d} = 31.25ns$

   As $T_w = 0$

   $T_0 = H_{avg}T_{rmin} + T_s = 271.25ns$

2. Ans

   For a big n stages, N=2^n nodes

   The geometric calculation denotes that

   $\text{avg} = 10(\text{n} - 1 + \sqrt{1 + 2^{2n-6}} + \sqrt{1 + 2^{2n-8}} + \cdots)$

   for that in fig4.3, avg = 10(n-1),

   i.e. it is $(\sqrt{1 + 2^{2n-6}} + \sqrt{1 + 2^{2n-8}} + \cdots)$ shorter

3. Ans

   Tr = 20ns

k	n	w	Θ_{ideal}	W_n	W_s	T
2	12	2	8	5	2	376
4	6	4	8	10	4	248
8	4	8	8	16	8	224
16	3	16	8	21	16	273
64	2	32	4	32	32	656
4096	1	64	0.125	64	64	20488

   The minimal latency occurs when n=4. However, the latency of 224 ns when n=3 is close enough that it would probably be chosen to gain the packaging and wire length advantages of a lower dimension.