1

ANS

a) P0.B0 (S, 120, 00 20)

b) P0.B0 (M, 120, 00 80)

P3.B0 (I, 120, 00 20)

c) P3.B0 (M, 120, 00 80)

d) M: 110 ← 30

P1.B2 (S, 110, 00 30)

P0.B2 (S, 110, 00 30)

e) P0.B1 (M, 105, 00 48)

P3.B1 (I, 105, 00 08)

f) M: 110 ← 30

P0.B2 (M, 130, 00 78)

g) P3.B2 (M, 130, 00 78)

2

ANS

Processor Request	**Activity**	**A's Cache & Status**	**B's Cache & Status**	**Memory x**
Core B reads x	Cache read miss		7 (E)	7
Core A reads x	Cache read miss	7(S)	7 (S)	7
Core B writes 2 to x	Write hit, Invalidation for x	7(I)	2 (E)	2
Core A reads x	Cache read miss	2(S)	2 (S)	2
Core B writes 5 to x	Write hit, Invalidation for x	2(I)	5 (E)	5

3

ANS

Processor Request	**Activity**	**A's Cache & Status**	**B's Cache & Status**	**Memory x**
Core A reads x	Cache read miss	8(E)		8
Core B reads x	Cache read miss	8(S)	8 (S)	8
Core A writes 3 to x	Write hit, Write update for x	3(S)	3 (S)	8
Core A writes 4 to x	Write hit, Write update for x	4(S)	4 (S)	8
Core B reads x	Read hit	4(S)	4 (S)	8

4

ANS

a)

i.

64 processor arranged a as a ring: largest number of communication hops

= 32 → Communication cost

= 100 + 10 x 32

=420 ns.

ii.

64 processor arranged as 8x8 processor grid: largest number of communication hops

=14 → communication cost

=100 + 10 x 14

=240 ns

iii.

64 processor arranged as a hypercube: largest number of hops

= 6 ($\log_2 64$) → Communication cost

= 100 + 10 x 6

= 160 ns

b)

i.

64 processor arranged a as a ring: Worst case CPI

=0.75 + (0.2/100) x 420

=1.34 cycles/inst

ii.

64 processor arranged as 8x8 processor grid: Worst Case CPI

=0.75 + (0.2/100) x 240

= 0.98 cycles/inst

iii.

64 processor arranged as a hypercube: Worst case CPI

=0.75 + (0.2/100) x 160

= 0.82 cycles/inst

The average CPI can be obtained by replacing the largest number of communication hops in the above calculation by $\hat{h}$, the average numbers of communications hops. That latter number depends on both the topology and the application.