Q1.

TLB.

Valid	tag	physical Page Number.
1	8	1
1	3	6
1	12	2
1	11	12

Page table

Valid.	Physical Page or in Disk
1	5
1	~~Disk~~ 0
0	Disk
1	6
1	9
1	11
0	Disk
1	4
1	~~Disk~~ 1
0	Disk
1	3
1	12

address	Page #	TLB	Page table
4669	1	miss	Page fault
2227	0	miss	hit.
13916	3	miss	hit.
34587	8	miss	fault
48870	11	miss	hit.
12608	3	hit	hit.
49225.	12.	miss	fault.

1 2.

Q2. TLB.

Valid	tag	Physical Page #
1	5	11
1	4	9
1	1	0
1	6	5

Valid	Physical Page or in Disk
1	5
1	~~Disk~~ 0
0	Disk
1	6
1	9
1	11
1	~~Disk~~ 1
1	4
0	Disk
0	Disk
1	3
1	12

address	Page #	TLB	Page table.
4669	0	miss	hit.
2227	0	hit	hit.
13916	1	miss	fault.
34587	4	miss	hit.
48870	5	miss	hit.
12608	1	hit	hit.
49225	6	miss	fault

advantage: need small Page table

disadvantage: more overhead bring page from

3 page table size:

32 bits: 8KB ⇒ 13 bits

32 − 13 = 19 bits. 2^{19} = 512K entries

512K * 4 Bytes = 2MB.

2MB * 5 = 10MB.

4. That page was kicked off by other applications.

or that page has some error ... etc.

5.

set 0	~~0 4 8 12 0~~ ~~8 8 12 16~~
set 1	

0 2 4 8 10 12 14 16 0

X X X X X X X X X

miss: 9

hit: 0

6:

set 0	0 ~~8 4 8 12 16~~
set 1	

0 2 4 8 10 12 14 16 0

X X X X X X X X ✓

7.

x[0]	5	5	6	6
x[1]	3	5	5	3

doesn't ensure coherency: X[0]=5 X[1]=2.

8:

C	0	0	2	2	3
D	0	1	1	3	3

9. benchmark A: shared: $20 + 0.12\% \times 180 = 20.216$

private: $5 + 0.3\% \times 180 = 5.54$

benchmark B: shared: $20 + 0.03\% \times 180 = 20.054$

private: $5 + 0.06\% \times 180 = 5.108$

private is better.

10 16KB ÷ 64B ÷ 4 = 256 sets ⇒ 8 bits. index

64B ⇒ 6 bits. block offsets

page size: 16KB ⇒ 14 bits for. page offsets