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Computer Engineering

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Ans 4) Given,

   CPU with 48 bit hardware.
   Page size = 8 KB
   Page table entry size = 4 bytes

Ans b

a) LRU cache replaces the page that is least recently used.

From the given details, Page 1 was least recently used at time T=260 clock ticks.
Hence it will be replaced.

b) For the second replacement, Page 3 was least recently used at time T=265 ticks.
Hence, it will be replaced.

Ans☐ Given,
No. of bits for segment = 4
No. of bits for page = 16
No. of bits for offset = 12

i) When the user searches for Ox CODEBAD,
~~# the address~~ it is looking for in binary, is:-
the ~~code~~ segment he is looking for ~~Ox~~C.
~~Or~~ Page in Segment = Ox ODED
Offset = Ox BAD.

If the required entry is found in the Segment OxC, ~~and~~
then the validity is checked.
Then, the PTE ~~OxDE~~ OxODED x 4 is checked and the
physical page is found.
It is then shifted by OxBAD offset.
Hopefully, all that was in TLB and cached in hardware.

ii) ~~If~~ it is paged out to disk, when you look at PTE instead
of a physical page number, Present bit is unset and disk offset
to the page on disk and generate a page fault.
The OS then requests that block to be loaded.
When the page is returned, a physical page is allocated,
and process is continued.

iii) At any of the steps, we can find invalid PTE, an address out
of bounds etc.. in which the process would raise a page
fault and since its not valid, it is killed.

Given Reference String;

5 0 4 4 0 3 0 4 1 0 2 0 5 3 0 1

No. of frames =3

5	0	04	4	0	3
→ 5 (010)	5 (10)	5 (10)	5 (10)	5 (10)	3 (10)
	→ 0 (10)	0 (10)	0 (10)	0 (10)	→ 0 (00)
		→ 4 (10)	→ 4 (11)	→ 4 (11)	4 (01)
F	F	F	F		F

0	4	1	0	2
3 (010)	3 (10)	3 (10)	3 (10)	2 (10)
→ 0 (00)	→ 0 (00)	1 (11)	1 (11)	→ 1 (01)
4 (01)	4 (01)	→ 4 (01)	→ 0 (10)	0 (01)
		F	F	

0	5	3	0	1
2 (10)	2 (10)	→ 2 (00)	0 (10)	0 (10)
→ 1 (01)	5 (10)	5 (00)	→ 5 (00)	1 (10)
0 (10)	→ 0 (10)	3 (00)	3 (10)	→ 3 (10)
	F	F	F	F

Total faults= 8 (Including 3 initial faults)

Ans e:- The logical map, page table and physical map will be as follows:-

Logical map

0	a
	b
	c
	d
1	e
	f
	g
	h
2	i
	j
	k
	l
3	m
	n
	o
	p
4	q
	r
	s
	t
5	u
	v

Page Table

Page Number	Frame Number
0	7
1	26
2	52
3	20
4	55
5	6

Physical Map

	Content
6	u
	v
	.
	.
7	a
	b
	c
	d
20	m
	n
	o
	p
26	e
	f
	g
	h
52	i
	j
	k
	l
55	q
	r
	s
	t

Physical address = Page size* frame number + offset

Physical address of m = 80 (4×20)
Physical address of d = 31 (4×7+3)
Physical address of v = 25 (4×6+1)
Physical address of r = 4×55+1 = 221

External fragmentation = 0
Internal fragmentation = 2