Problem 1

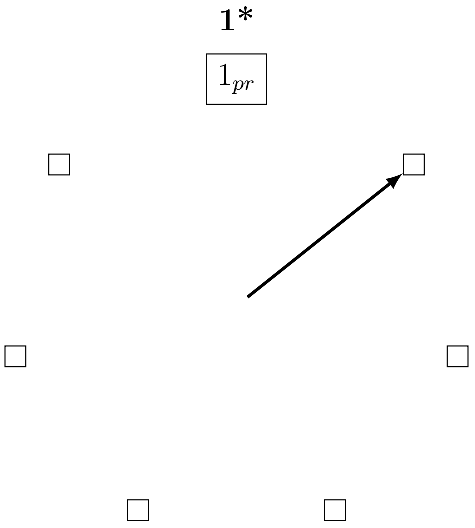
(a) LRU Replacement Policy

Instruction:	1*	2*	3*	$\underline{1}$	4*	5*	$\underline{3}$	$\underline{4}$	1	6	7	8*	9*	5	10
Frame 1	**1**	**1**	**1**	1	1	1	1	1	1	1	1	1	1	1	10
Frame 2		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Frame 3			**3**	**3**	**3**	**3**	3	3	3	3	3	**8**	**8**	**8**	**8**
Frame 4					**4**	**4**	**4**	4	4	4	4	4	**9**	**9**	**9**
Frame 5						**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Frame 6										6	6	6	6	6	6
Frame 7											7	7	7	7	7

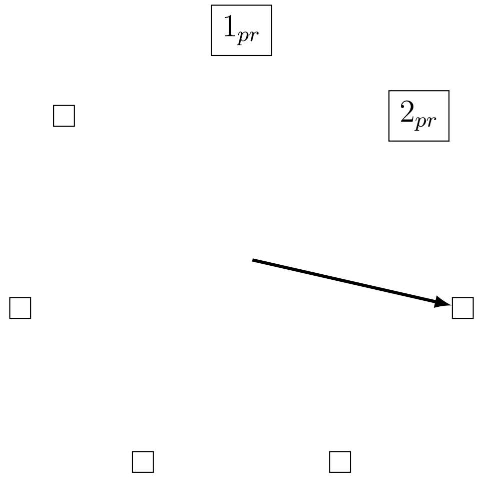
Note: pages in bold are pinned.

(b) Clock Replacement Policy

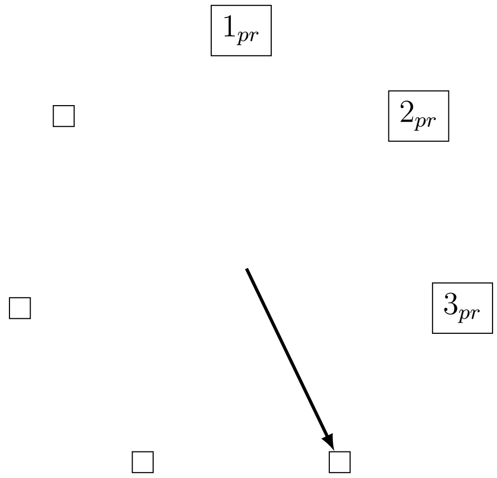
Note: a subscrpt p indicates that a page is pinned, and a subscript r indicates that the reference bit is set to 1.



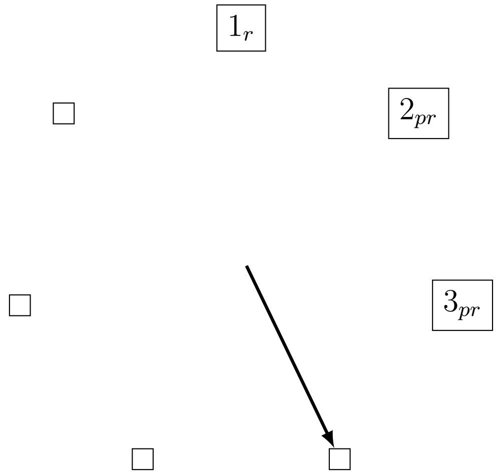
2*



3*



1



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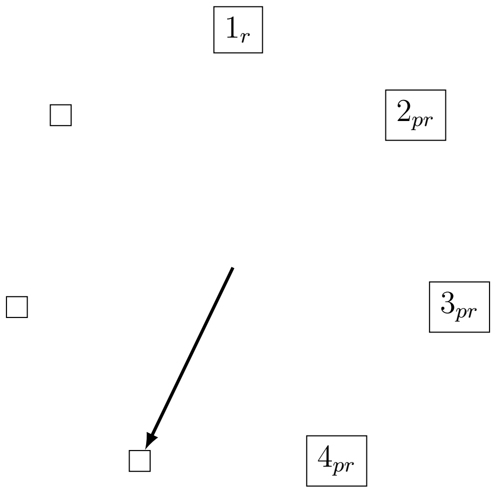

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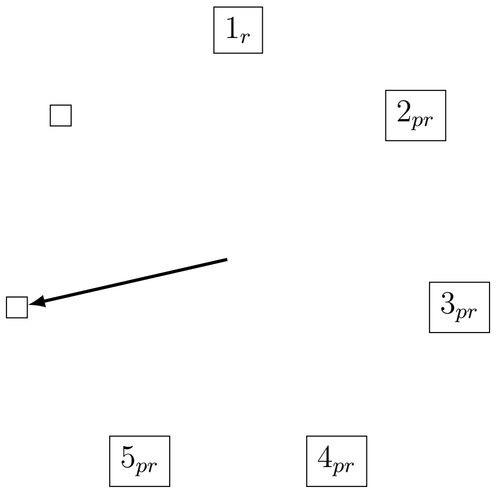
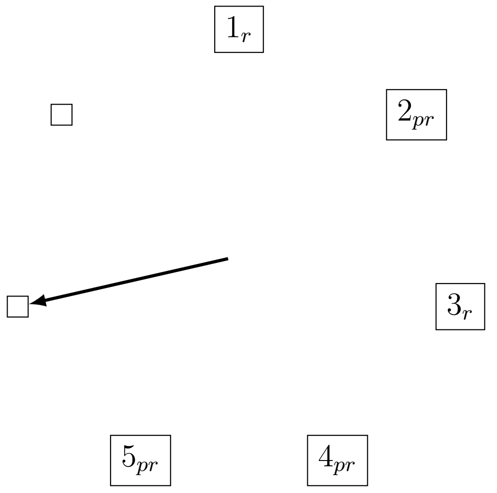


<u>3</u>



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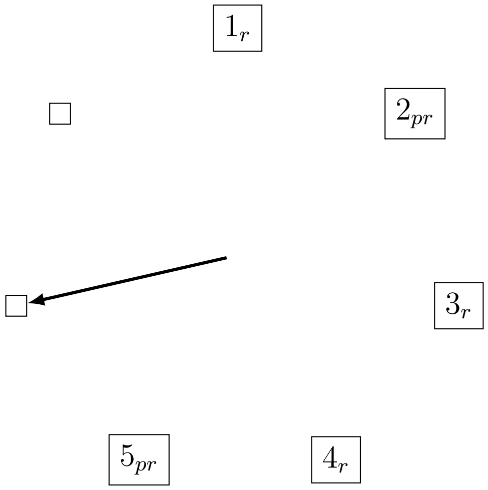
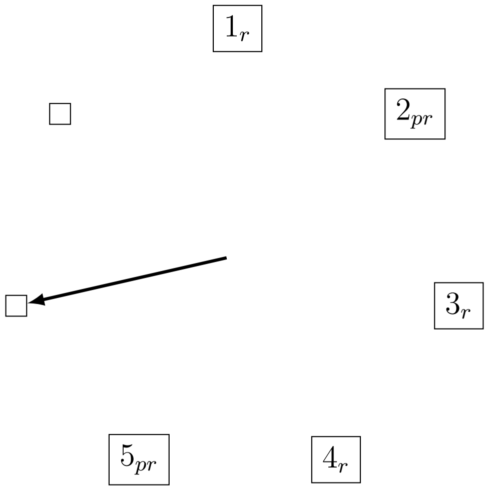
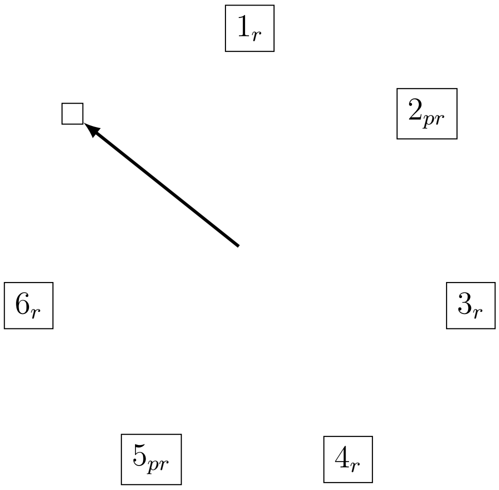


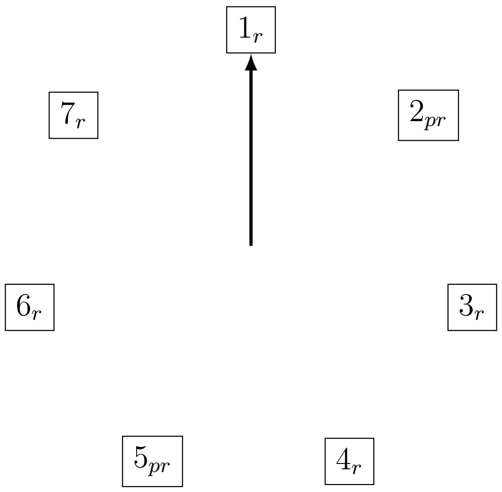
1



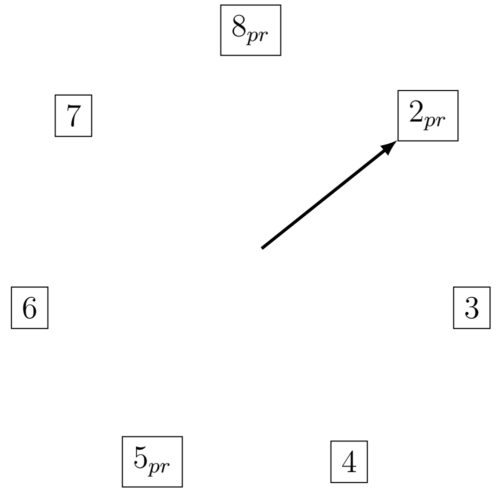
6



7



8*



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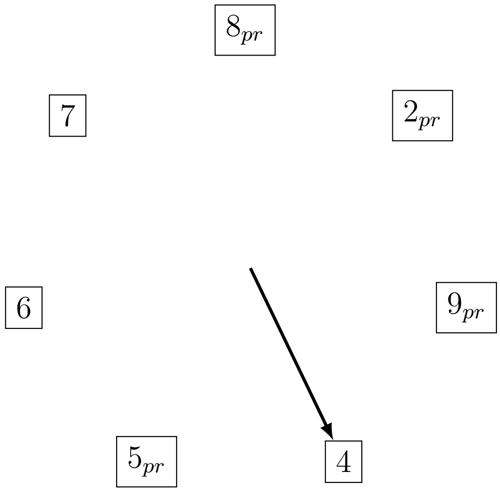
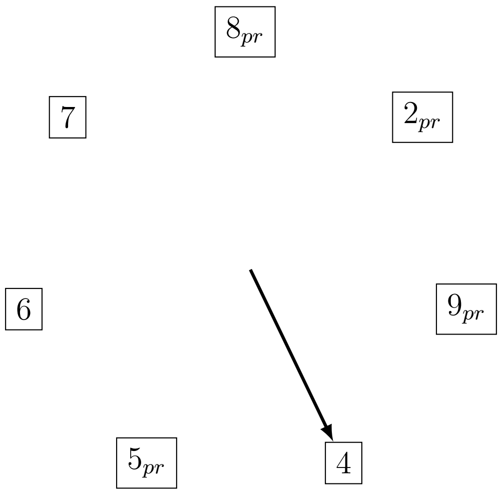
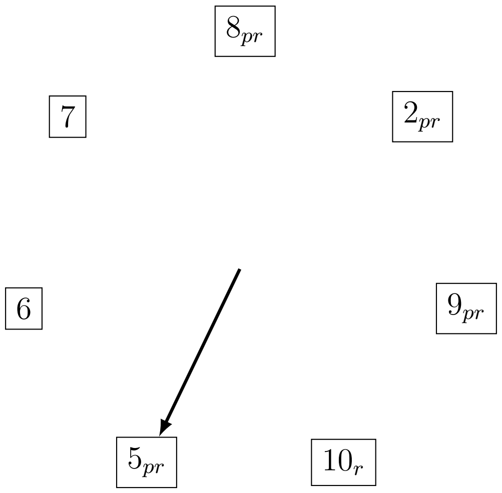


5



10



Problem 2

1. Yes. Each entry in the index would contain the value of K1 (20 bytes) and a pointer to the corresponding record (8 bytes). The entire data file contains 20 million records, so the index file would be 28 million bytes. Each block can contain $\lfloor 8,192/28 \rfloor = 292$ index records. The entire index would therefore be $\lceil 28,000,000/292 \rceil = 95,891$ blocks.

2. Yes. Each entry in the index would contain a pointer to the start of a block in the data file, and the value of K1 for the first record in that block. Since each block in the data file contains 20 records, you would need $1,000,000/20 = 50,000$ entries in the index, which would take up $\lceil 50,000/292 \rceil = 172$ blocks.