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Operating System:
Virtual Memory Questions

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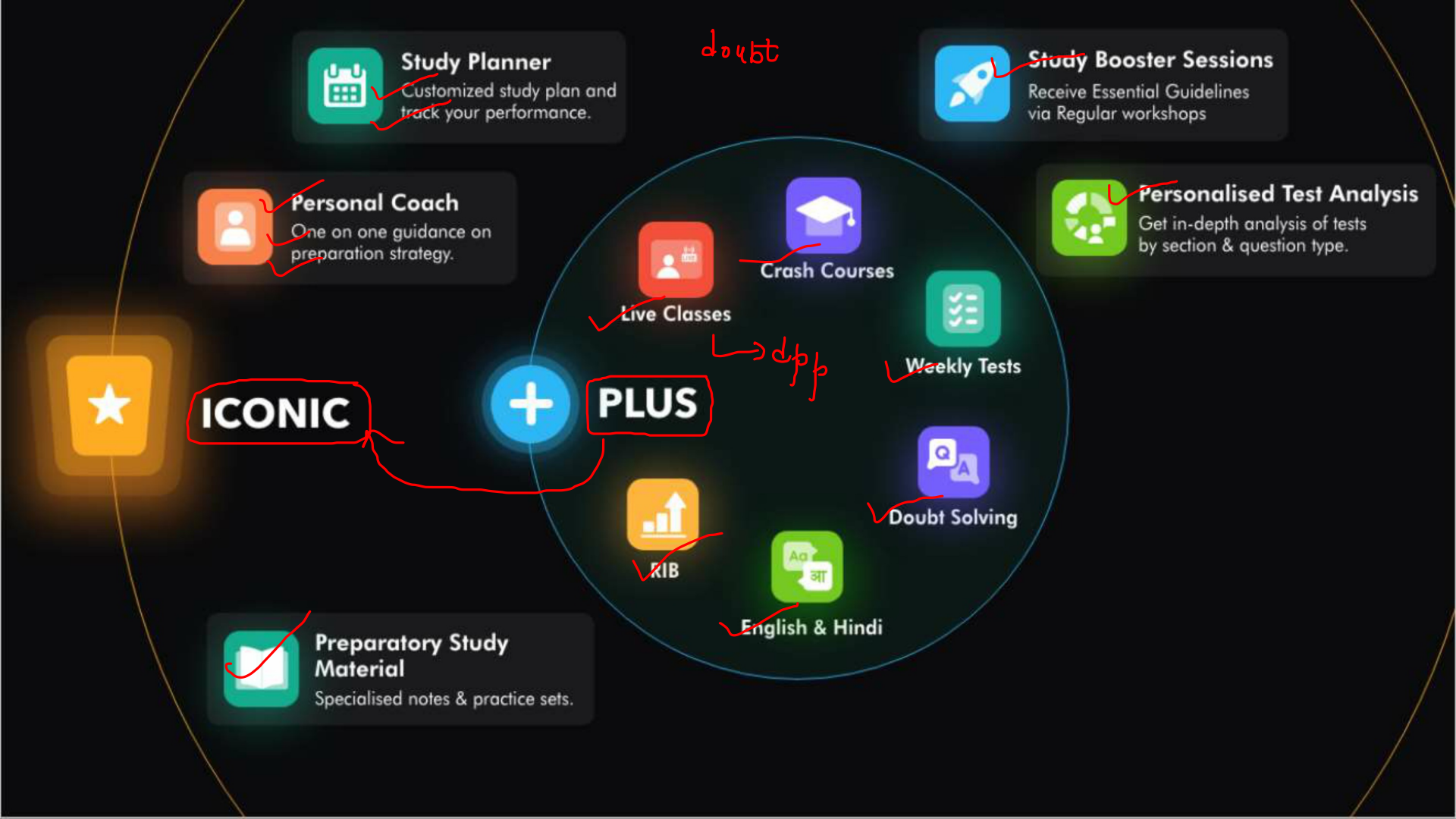
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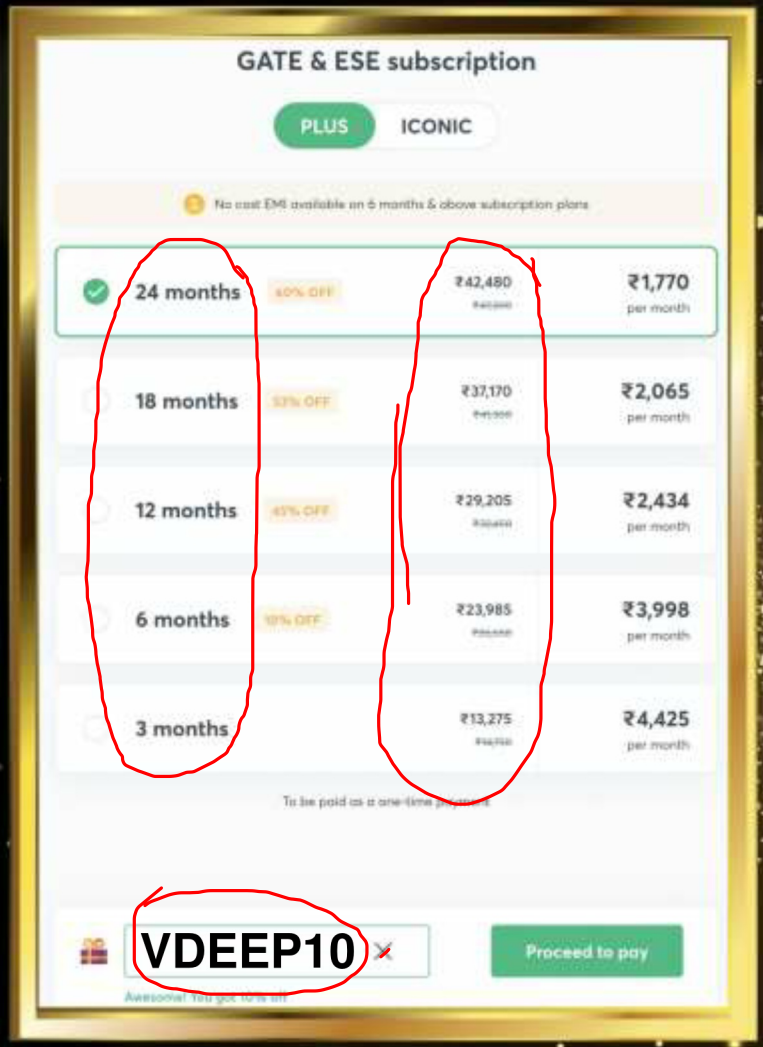
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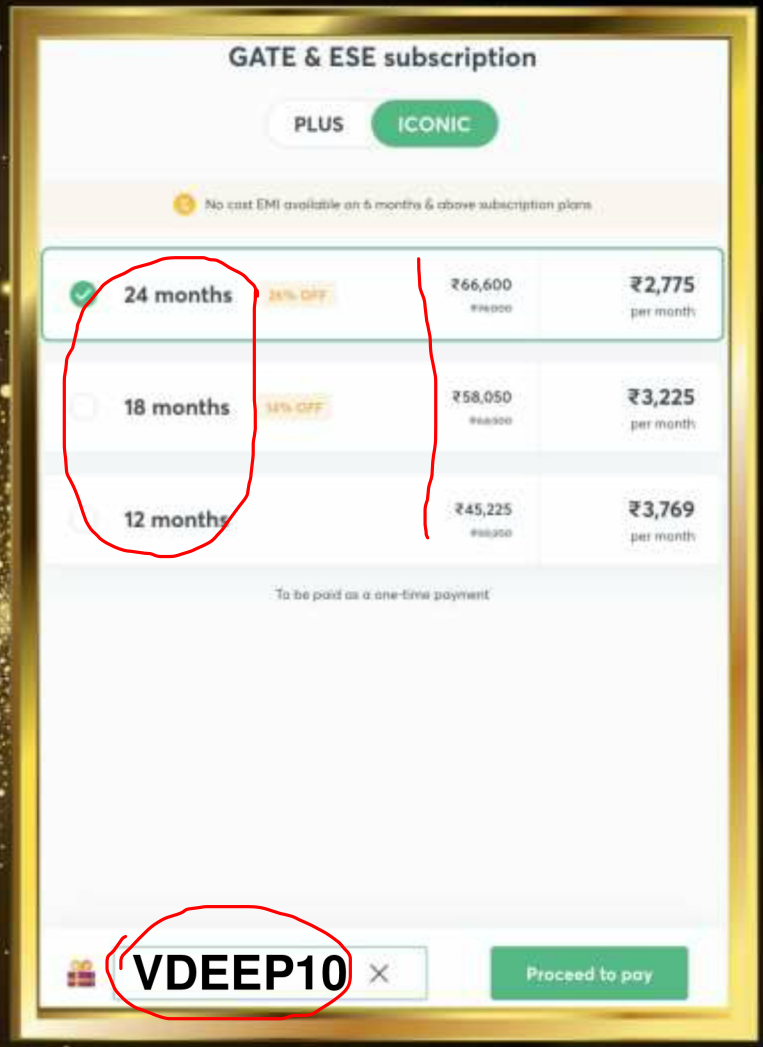
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Are You Ready??

Question 1

When a program tries to access a page that is mapped in address space but not loaded in physical memory, then _____

a) segmentation fault occurs

b) fatal error occurs

c) page fault occurs

d) no error occurs

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Question 2

Effective access time is directly proportional to _____

a) page-fault rate

b) hit ratio

c) memory access time

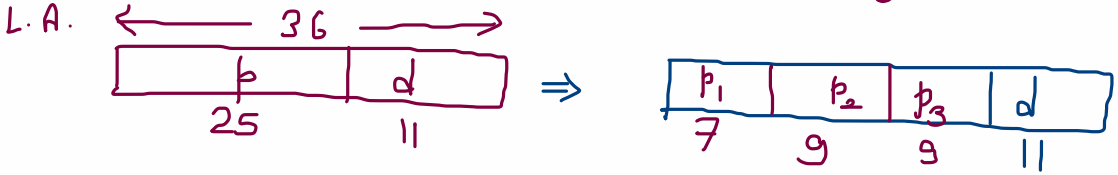
d) none of the mentioned

Question 3

Consider a paged memory system with virtual address of 36-bits and physical address of 28-bits. The page size is 2KB. Further consider that one page table entry size is 4bytes.

↳ 2^{11}B ⇒ offset = 11-bits

1. Page table size is? $2^{25} * 4B = 2^{27}B = 128MB$
2. Can we store entire page table in single page? If not then how many levels of page table required? No, 3 level paging required



no. of P.T. entries in single page = $\frac{2KB}{4B} = 2^9$

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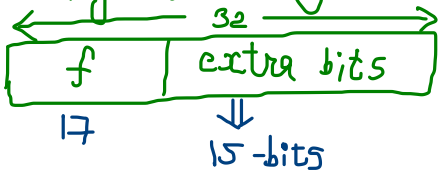
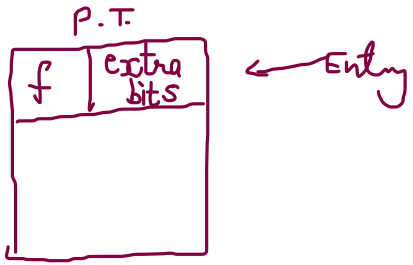
Ques) From previous quest^{n} in each page table entry, how many bits are stored for protection etc. ?

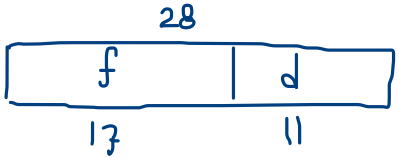
Page table entry



Sol^{n} :-



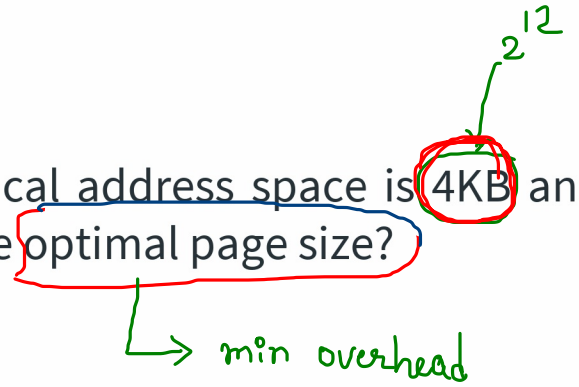
P.A.



Ans = 15-bits

Question 4

In a paging scheme, logical address space is 4KB and page table entry size is 8 bytes. What should be the optimal page size?



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Solution 4

Optimal page size = $\sqrt{2 * LAS * E}$ $= \sqrt{2 * 4KB * 8B} = \sqrt{2^{16}B * B}$

$= 256B$

LAS = Logical address space

E =Page Table Entry Size

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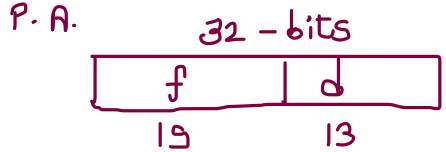
Question 5



A computer system implements 8 kilobyte pages and a 32-bit physical address space. Each page table entry contains a valid bit, a dirty bit, three permission bits, and the translation. If the maximum size of the page table of a process is 24 megabytes, the length of the virtual address supported by the system is 36 Ans bits.

$e = \underset{19}{f} + 1 + 1 + 3 = 24\text{-bits} = 3B$

P. A = 32-bits

Page = 8 KB = 2^{13} B

P. T. size = 24 MB

V. A.

$\Rightarrow$ 36-bits

P. T. size = $2^{p} * 3$ Bytes

$24MB = 2^{p} * 3B$

$2^{p} = 8M \Rightarrow 2^{p} = 2^{23}$

p = 23-bits

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Question 6

Consider a 2-level paging in which main memory access time is 200ns, TLB access time is 20ns and TLB hit ratio is 90%. What is the effective memory access time?

$$E.M.A.T. = H * (t_{TLB} + t_{mm}) + (1-H)(t_{TLB} + 3t_{mm})$$

↳ 2 times for translatn

1 for content

$$= 0.9 * (20 + 200) + 0.1 (20 + 600)$$

$$= 260 \text{ nsec}$$

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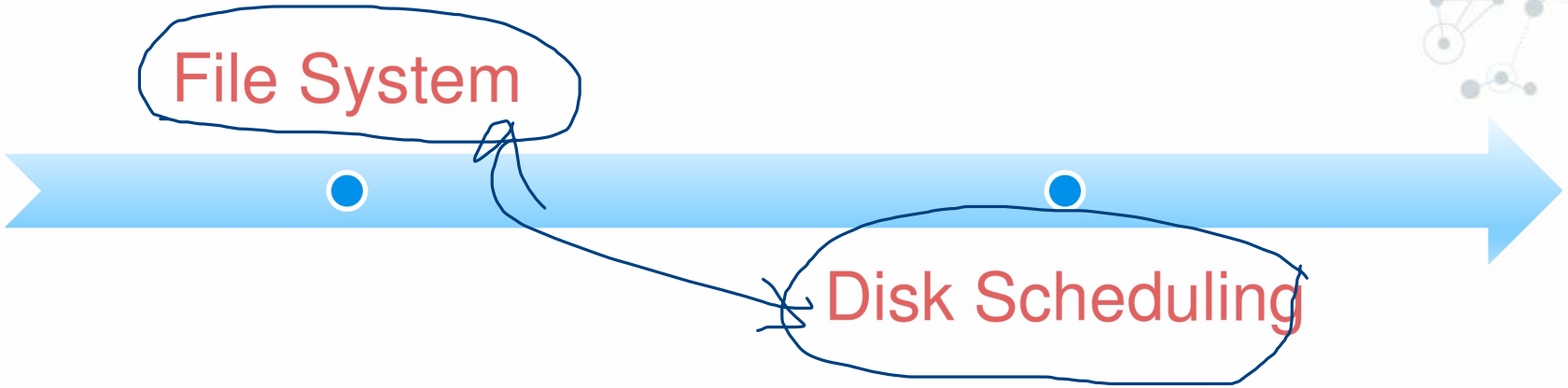

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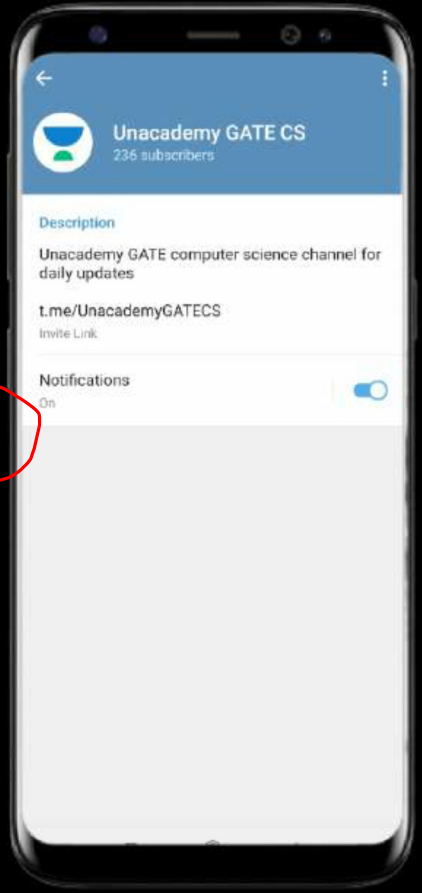

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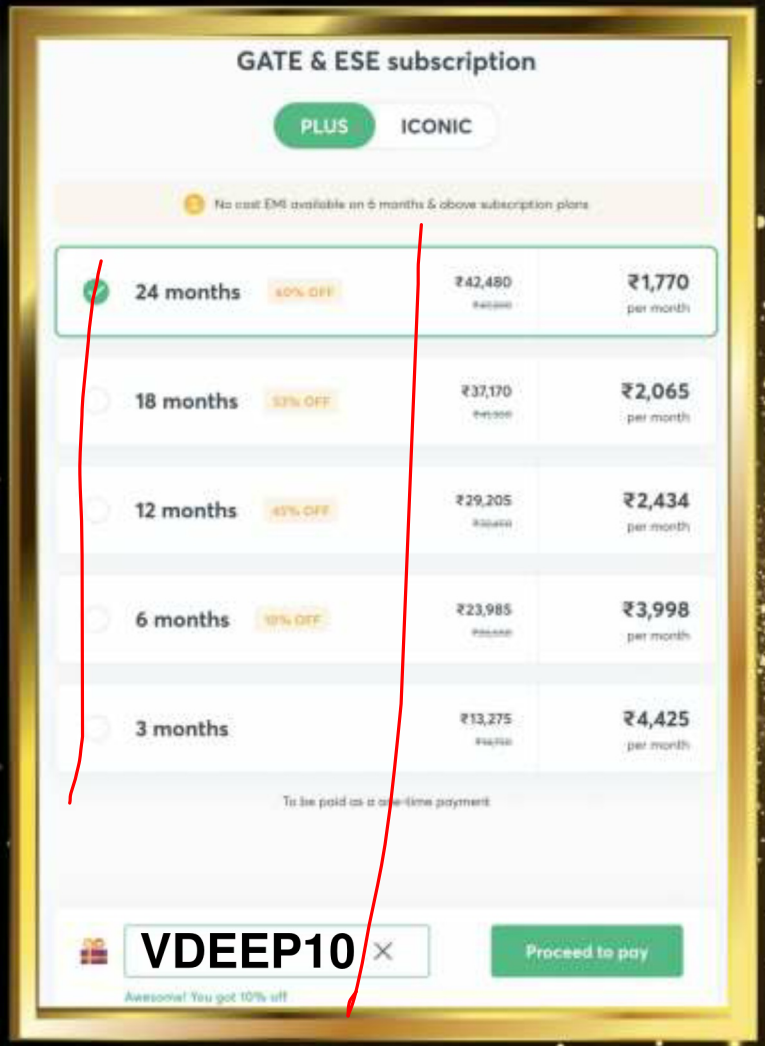
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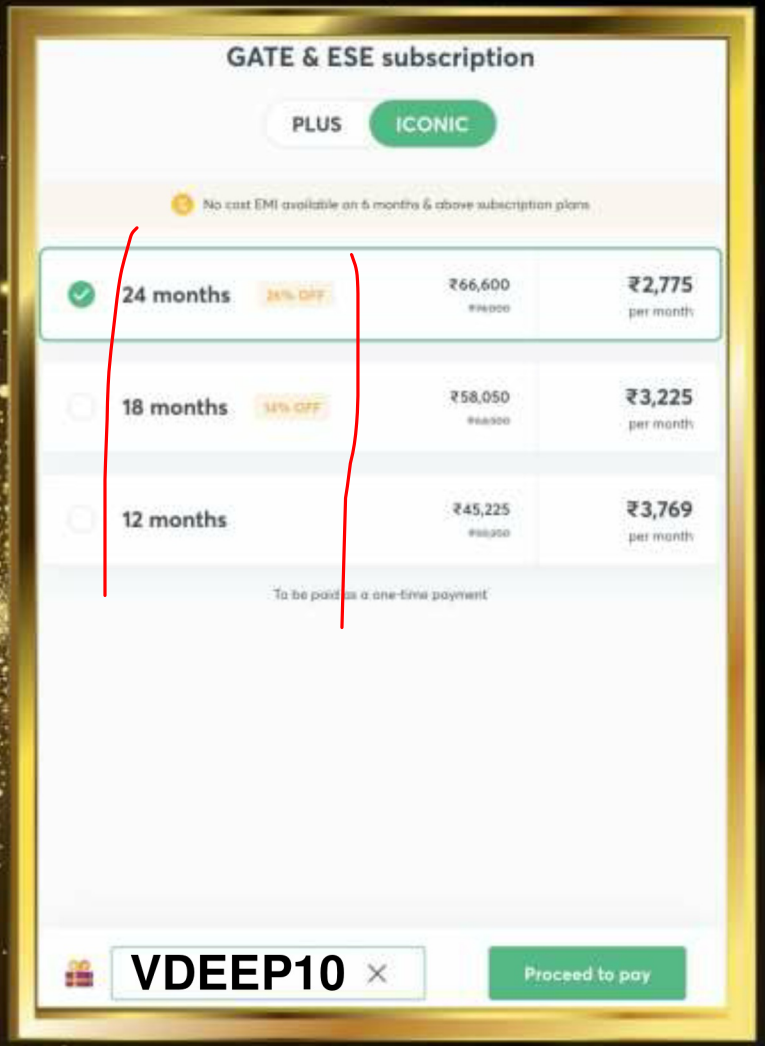
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