POSTAL BOOK PACKAGE 2025

ELECTRICAL ENGINEERING

CONVENTIONAL Practice Sets

CONTENTS

COMPUTER FUNDAMENTALS

1 CHAPTER

Digital Logic

Q.1 Find the minimum product of sums of the following expression:

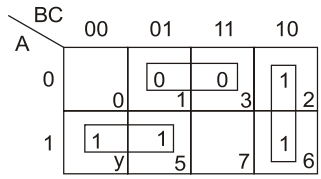
$$f = ABC + \bar{A}\bar{B}\bar{C}$$

Solution:

In order to find the minimum product of sums we must calculate what are the max terms.

We have SOP function as:

$$f = ABC + \bar{A}\bar{B}\bar{C}$$



$\Rightarrow$ Minimum terms are (0, 7)

Thus, maximum terms = (1, 2, 3, 4, 5, 6)

By using K-map

Hence, minimum product of sum will be $(\bar{A}+B)(A+\bar{C})(\bar{B}+C)$

Q.2 Show with the help of a block diagram represent Boolean function:

$$f = AB + BC + CA$$

can be realised using only 4 : 1 multiplexer.

Solution:

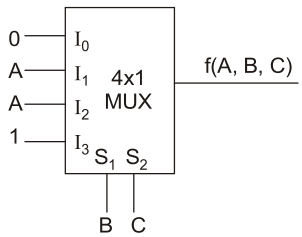
$$f = AB + BC + CA$$

A \ BC	00	01	11	10
0	0 0	0 1	1 3	0 2
1	0 4	1 5	1 7	1 6

Using MSB method:

	I_0	I_1	I_2	I_3
$\bar{A}$	0	1	2	③
A	4	⑤	⑥	⑦
	0	A	A	1

Implementing $f(A, B, C)$ using 4×1 MUX



2 CHAPTER
Computer Organization and Architecture

Q.1 What is interrupt? Discuss all major types of interrupt.

Solution:

Interrupts: In the process of executing a program, the CPU may be interrupted by a number of signals called interrupts. These interrupts can be categorised into following types.

(a) External Interrupts (b) Internal Interrupts (c) Software Interrupts

External Interrupts: External Interrupts includes interrupts from some external devices such as from an I/O device when a data needs to the transferred or when data transfer is finished. This may also occur from an external timing device when some time-out has occurred or from a power monitoring device when a power failure has occurred.

Internal Interrupts: Internal Interrupts include errors resulting out of incorrect program syntax or logic. This would include both compile time and run time errors. Examples are division by zero error, register over flow error, stack overflow error, etc. Internal interrupts are caused by programs and not by any external devices.

Software Interrupts:

- Software Interrupts takes place when an application program calls a supervisor program such as operating system. It occurs under such conditions when a user program requests the operating system for handling some special, privileged operations such as input/output operations.
- Every interrupt is associated with a subroutine also called a service routine, which handles the interrupt; when the CPU encounters an interrupt, it transfers its attention from a currently running program to the service routine. Control returns to the original program after the service program is executed. In order to return to the same stage of the previous program where it had left, certain things need to be saved before jumping to a service program. These are:
  (a) The contents of the Program Counter (PC).
  (b) The contents of all Processor Registers.
  (c) The contents of status register.

Stack comes very handy for storing the return address, where the CPU has to return after executing a subroutine, especially in cases of recursive subroutines. A recursive subroutine is a subroutine that calls itself. If a single register is used for storing the return address, when the recursive subroutine calls itself, the previously stored return address is destroyed. This will not happen if a stack is used. The return addresses can be pushed into the stack without destroying any previous values. The topmost value in the stack always gives the address where the CPU controls needs to be returned next.

Q.2 (a) What is Hit Ratio?

(b) The Access time of a cache memory is 100 nsec and that of main memory 1000 nsec. It is estimated that 80% of memory requests are for read and remaining 20% for write. The Hit Ratio for Read Access is only is 0.9 :

(i) What is the average access time of system consider only memory read cycles?

(ii) What is the average access time of system for read and write required? 80% Read, 20% Write.

Solution:

(a) **Hit Ratio:** The performance of cache memory is frequently measured in terms of a quantity called Hit ratio. When the CPU refers to cache and find the word there, it is said to produce a Hit and if the word is not found in cache, it is in main memory and it is counts as Miss.

$$\text{Hit ratio} = \frac{\text{Number of times word found in cache}}{\text{Total number of CPU reference}}$$

$$\boxed{\text{Hit Ratio} = \frac{\text{Hit}}{\text{Hit} + \text{Miss}}}$$

(b) Given data, Cache access time = 100 nsec.

Main memory access time = 1000 nsec.

Hit ratio = 0.9

(i) Average access time for memory read cycles-

Average AT = 0.9 (100 nsec.) + 0.1 (100 + 1000)

Averate AT = 90 + 110

Averate AT = 200 nsec

(ii) Average AT = $0.80 \times 200 + 0.20 \times 100$

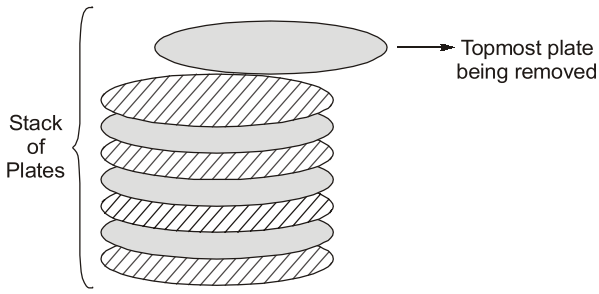
= 160 + 20 = 180 nsec

Q.3 What is memory stack? And how POP and PUSH functions are performed in stack?

Solution:

Memory Stacks:

- A stack can be considered as a storage method in which the items are stored in consecutive memory locations and the last element stored in a stack is the first element retrieved. Stack is also known as LIFO (Last in First out) list. You can visualize a stack as set of plates placed one above the other as shown in figure. When you want to place a new plate, you will have to place it the top. When you want to withdraw a plate you will take out top most plate first. That is the plate last kept is the first taken out or last in first out.



- A stack may be a finite number of registers placed together or it can also be a part of memory unit. An address register is associated with stacks. This address register called stack pointer contains the address of the recently stored elements. Remember that this is the element which will be first retrieved. Stack pointer always points to the topmost element in the stack.

How POP and PUSH Functions are Performed in Stack?

The process of removing an element from the stack is called "Pop" operation and is done by decrementing the stack pointer. The process of inserting an item into stack is known as "Push" operation and is done by incrementing the Stack Pointer (SP). As seen in figure, the register SP (Stack Pointer) points to the topmost i.e. recently inserted element.