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**Section:** C

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**Question # 1**

**OPCODE:**

Opcode (full form operation code also known as instruction code) is a piece of machine language instruction that identifies the operation to be performed.

**OPERAND:**

Operand is the part of machine language instruction on which the operation is performed.

**EXAMPLE WITH EXPLANATION:**

1. ADD A, B
2. MOV A, B

In example, 1 and 2 ADD and MOV are the opcode while A,B are the operands.

In MIPS, Op(6 bit) Rs(5) Rt(5) Rd(5) Shamt(5) Funct(6)

Op is the opcode, Rs is the 1st operand, Rt is the 2nd operand, Rd is the destination register, Shamt is the shift amount, Funct is the function code.

**Question # 2**

**CONTROL SEQUENCER**

It controls the function doing in SAP, Means that it controls the process in SAP. It generates the control signals for each so that action occur in desired sequence. CLK signal is use to synchronize the overall operation of SAP. Control Sequencer decides that which component of SAP will be active at a specific time. It consist of 12-bit CON word by which it can be decide that which component will be active at this time.

**USE of 12 bit CON Word**:

A 12-bit word comes out of the Controller-Sequencer block. This control determines how the registers will react to the next positive CLK edge.

CON word contains:

Cp, Ep, Lm', CE', Li', Ei', La', Ea, Su, Eu, Lb', Lo' this is the CON word which is uses to control the process running in SAP.

**Question # 3**

**ALU**

ALU (arithmetic and logical unit) handles all the arithmetic and logical operations.

**FLAGS**

Flags represent the operation of ALU. It gives useful information regarding the result of the operation that occurred in the ALU.

**TYPES OF FLAGS**

There are 6 types of flags that include

S (sign flag): Indicates the sign on arithmetic or logical operation.

Z (zero flag): Indicates whether the result is 0 or not.

P (parity flag): Indicates LSB 1 if even and 0 if odd.

C (carry flag): Indicates carrying or borrowing.

A (auxiliary carry): Represents carrying or borrowing between half-bytes of an 8-bit arithmetic or logic operation. Used

O (overflow): Indicates any overflow

**EXAMPLE:**

If we subtract 2 from 2

Result is zero, so Z will be 1.

If we subtract 3 from 2.

Result is negative thus, S will be 1.

If we add 2 with 5.

Result is positive thus, S will be 0.

**Question # 4**

**HANDSHAKING:**

It is a process by which two devices start communication.

Handshaking begins when one device sends a message to another device indicating that it wants to establish a communications channel.

**HANDSHAKING IN SAP2**

In SAP2, when taking input form the hex decimal keyboard through input port 1, the Ready bit of input port 2 in turned on (1). After input is taken, the Ready bit has to be turned off. To do that, the Acknowledge bit in the Output port is turned on (1) which makes the Ready bit to turn off (0). After the input is taken and the Ready bit is turned off (0), the Acknowledge bit turns off (0). This process between the Ready bit and Acknowledge bit is called Hand Shaking in SAP2.

**Question # 5**

**STACK:**

A stack is a storage device that operates in a LAST IN FISRT OUT manner. Whenever we enter data in form of LIFO manner the element that has to be deleted first is the last inserted element.

**RELATION OF STACK WITH STACK POINTER.**

When a new data item is entered or "pushed" onto the top of a stack, the stack pointer increments to the next physical memory address, and the new item is copied to that address. When a data item is "pulled" or "popped" from the top of a stack, the item is copied from the address of the stack pointer, and the stack pointer decrements to the next available item at the top of the stack.