Assignment 2 & 3

Q1] Explain Comon bus System for four register transfer using neat diagram.

→ A typical digital computer has many registers and paths must Provided to transfer information from one register to another.

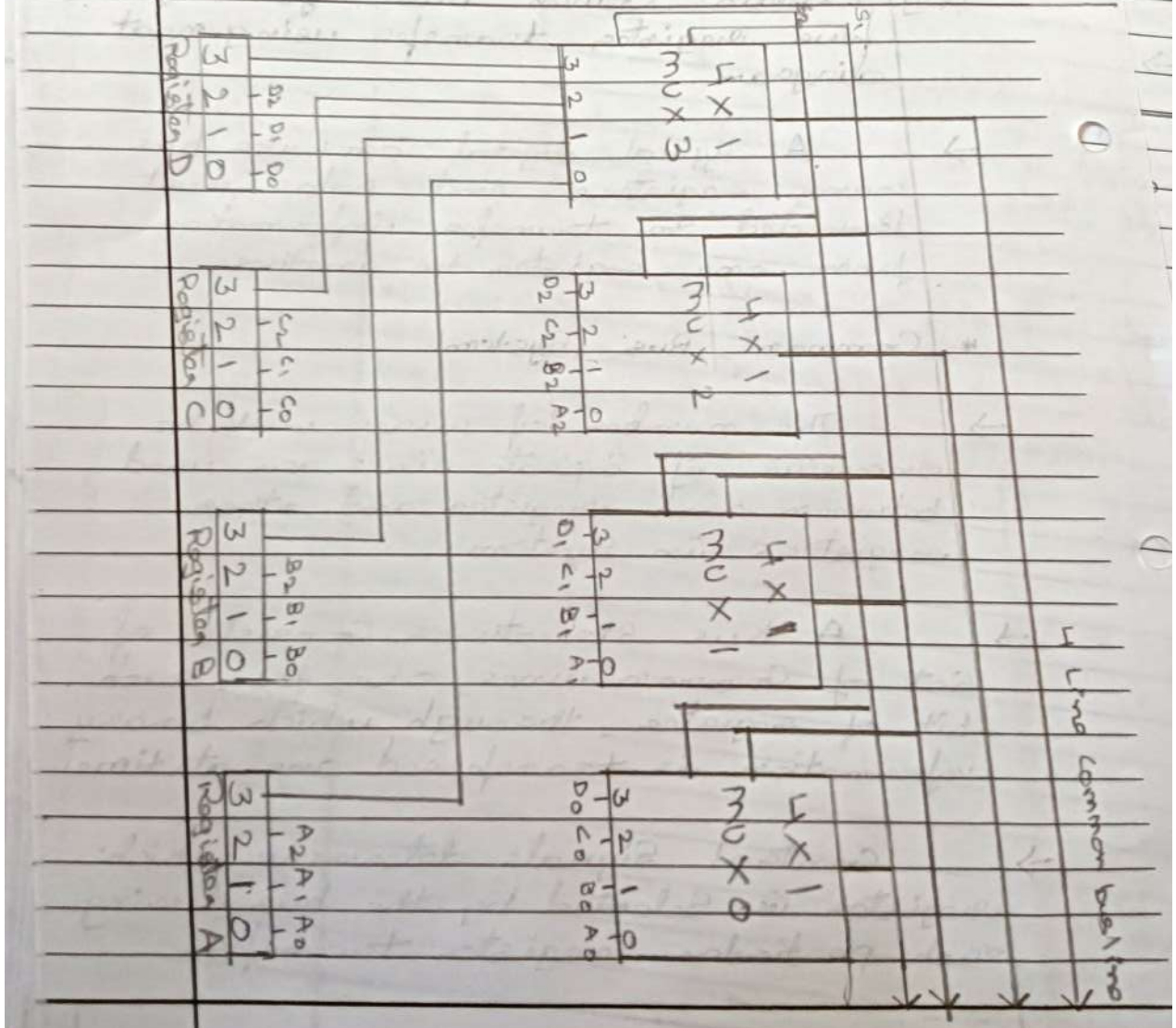
* Common Bus System.

→ The number of wires will be excessive if Separate lines are used between each register and other registers in System.

→ A bus structures consists of Set of common lines, one for each bit of register, through which binary information is transferred one at time.

→ Control Signals determine which register is Selected by the bus during each particular register transfer.

→ A more efficient scheme for transferring information between registers in a multiple register configuration is a common bus system.



S_1	S_0	Register Selected
0	0	A
0	1	B
1	0	C
1	1	D

→ The two selection lines S_1 & S_0 are connected to selected inputs of four multiplexers.

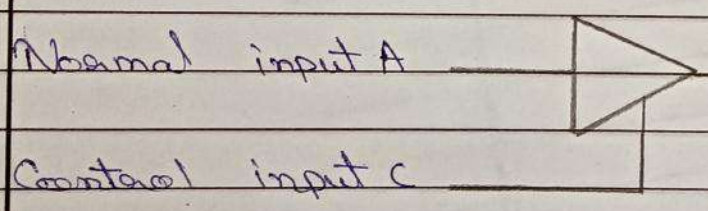
→ The bus lines to receive content of register A since outputs of register are connected to 0 data inputs of multiplexers. Similarly register B is selected if S_1 $S_0 = 1$ and so on.

Q2] Explain three - State buffer using diagram.

→ A bus System can Constructed with three state gates instead multiplexers A three state gate is digital Circuit that exhibits three states. Two of states are Signals equivalent to logic 1 and 0 as in Conventional gate.

→ The high - impedance state behave like open Circuit, which means that output is disconnected & does not logic Significance.

→ Three state gates may Perform may Conventional logic Such as "AND" or "NAND"



→ It has normal and Control input

→ The Control input determines output State.

→ When Control input, output is enable and gate behave like Conventional buffer.

→ When Control input 0, output is disable and gate goes the high impedance state.

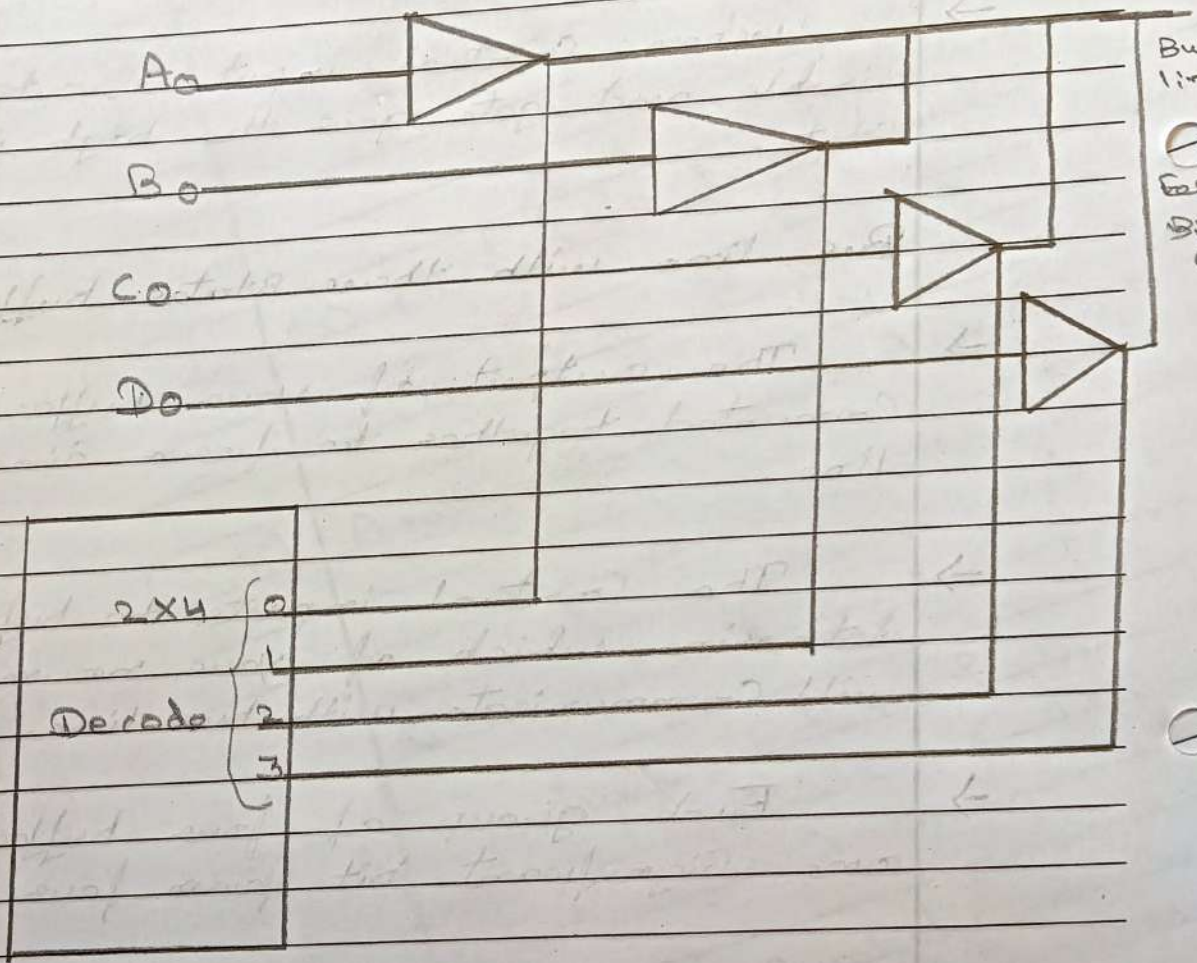
Bus line with three states buffer.

→ The output of four buffers are connected together to form single bus line.

→ The control inputs to buffers determine which of your normal inputs will communicate with bus line.

→ Each group of four buffers receives one significant bit from four registers.

* Diagram



Q3] Explain micro-operation and also explain arithmetic, micro operations, logic micro operations and shift micro operation in detail.

→ (i) micro operations :- Operation executed on data to store in registers are called micro operation. Register is one type of memory.

Eg:- (1) $\boxed{R_1}^{5} + \boxed{R_2}^{7} = \boxed{R_3}^{12}$

(2) $\boxed{R_1}^{5} + + = \boxed{R_1}^{6}$

ii] Arithmetic micro operation :-

→ The basic arithmetic operation are addition, Subtraction, Increament, Decrement.

→ Multiplication & Division are Void operation but it is not basic micro-operation.

→ Some Symbolic representation of arithmetic micro operation is given below.

Operations	Symbols
Addition	$C \leftarrow A+B$
Subtraction	$C \leftarrow A-B$
1's Compliment	$C \leftarrow A'$
2's Compliment	$C \leftarrow A'+1$
Increament	$C \leftarrow A+1$
Decreament	$C \leftarrow B-1$

Logic microoperation :- A group of bits called strings store in the register logic microoperation consider each bit of register as compared to arithmatic microoperation where take whole content register perform arithmatic.

AND Gate (multiplicati (0,1) on) $= 2^2 = 4$

0	0	0
0	1	0
1	0	0
1	1	1

OR Gate (Addition) $= 2^2 = 4$

0	0	0
0	1	1
1	0	1
1	1	1

1 1 0 1
1 0 1 0
1 0 0 0

Eg :- 1 1 0 1 1
0 1 0 1 1
1 1 0 1 1

iv] Shift microoperation :- Shift microoperation are used to shift content of register to left or right this functionality of shif microoperation useful for basic transfer of data.

→ There are three types of shifts.

1] logical ——→ Left shift denoted "shl" & Right shift denoted "shr"

2] Circular ——→ "cil" - Circular left shift
"cir" - Circular right shift.

3] Arithmetic →

"ashl" - arithmetic shift left.
"ashr" - arithmetic shift right.

Q4] Explain in brief about registers ALU and timing Control Circuit.

→ Instead of having individual registers performing micro-operations directly Computer System employ number storage registers Connected to Common operational Unit called arithmetic logic Unit.

→ The ALU performs operation and result of operation is then transfered to destination register.

→ The shift micro-operation are either performed in Separate Unit but Sometimes shift Unit made part of Overall ALU.

→ The arithmetic logic & shift Circuits introduced in previous Section Can Combined into one ALU with Common Selection Variables.

→ The data in multiplexer Selected with inputs S_3 and S_2. The other two data inputs to multiplexer receive inputs A_{i-1} For shift right & A_{i+1} For shift left operation one Stage of arithmetic logic Shift Unit is Shown.

Timing and Control Circuit.

→ The timing for all registers in basic Computer Controlled by master clock generator.

→ The clock pulses are applied to all Fin - Flops & registers in System including Fin - Flops & registers in Control Circuit.

→ The clock pulses do not change state of register unless register enabled by Control Circuit.

→ There are two types Control organization :-

i] Hard wired Control :- The hardwired - Organization Control logic is implemented with gates, Fin, Flops decoders & other digital Circuits It has advantage that optimized produces Fast mod of operation.

ii] Micro - programmed Control : The micro programmed organization the control information stored in control memory. The control memory is programmed to initiate required sequence micro-operation.

→ In block diagram of control Unit it consits of two decoders 0 sequence counter & number control logic gates.

→ The position of this register in common bus system is indicated in next to next slide.

→ The internal logic of control gates will be dwied later when we consider design of the computer in detail.

Q5] Explain Basic types of Computer instructions.

→ The instructions for the Computer are listed in pseudo code. The Symbol designation is three-letter word & represents an abbreviation intended Programmers & users.

→ The hexadecimal Code equal to equivalent hexadecimal number of binary Code used for instruction.

→ Instruction Set Completness.

→ The Set of instructions are said to Complete if Computer includes Sufficient number of instruction each of following :-

1] Arithmatic, logical & Shift micrcoperation.

2] Instructions moving information to & from memory and processor registers.

3] Program Control instructions together which instruction check Status Conditions.

4] Input and output Instructions.

→ There is basic four Instruction types:-

i] Functional Instruction:-
→ Arithmetic logic and shift instructions.
→ ADD, CMA, INS, CIR, CIL, AND, CLA

ii] Transfer Instruction:-
→ Data transfer between main memory & Processor reg.
→ LDA, STA.

iii] Control Instructions:-
→ Program Sequencing and Control.
→ BUN, BSA, ISZ.

iv] Input, output Instructions:-
→ Input and output.
→ INP, OUT.

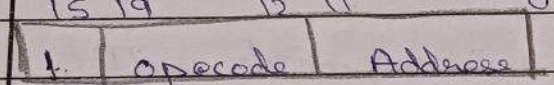
(Q6) Explain instruction Code format with suitable examples.

→ The basic Computer has three instruction Code formats.

→ Each format has 16 bits. The operation Code part of instruction Contain three bits & meaning of remaing 13 bits depends on operation Code encountered.

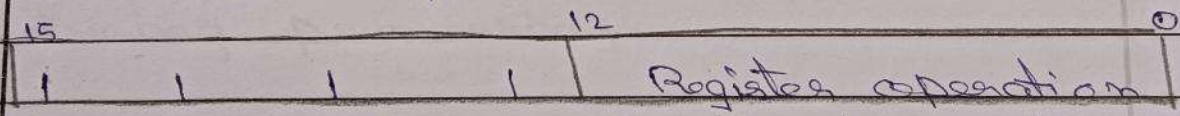
→ The type of instructions recognized by Computer Control from value bit in position 12 through 15 of instruction.

(a)



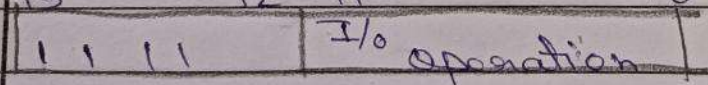
(Opcode = 000 through 110) memory - reference instruction.

(b)



(Opcode = 111, I=0) Register - reference instruction.

(c)



(Opcode = 111, I=1) Input - output instruction.

→ A "memory Reference Instruction" uses 12 bits to specify address one bit specify the addressing mode. I is equal to 0 for indirect address.

→ The "Register Reference Instruction" are recognized by operation Code 111 with 0 in left most bit of instruction. A Register Reference Instruction specifies operation on test of AC register.

→ An 'Input' output Instruction' does not need reference to memory and is recognized by operation Code 111 with 1 in leftmost bit of instruction.

Q7] Explain different types of registers in brief.

→ The Computer node processor register manipulating data & register for holding memory address.

→ The data register (DR) holds the operand read from memory.

→ The accumulator (AC) register is general purpose processing register.

→ The instruction read from memory placed in instruction register.

→ The temporary register (TR) is used for holding temporary data during processing.

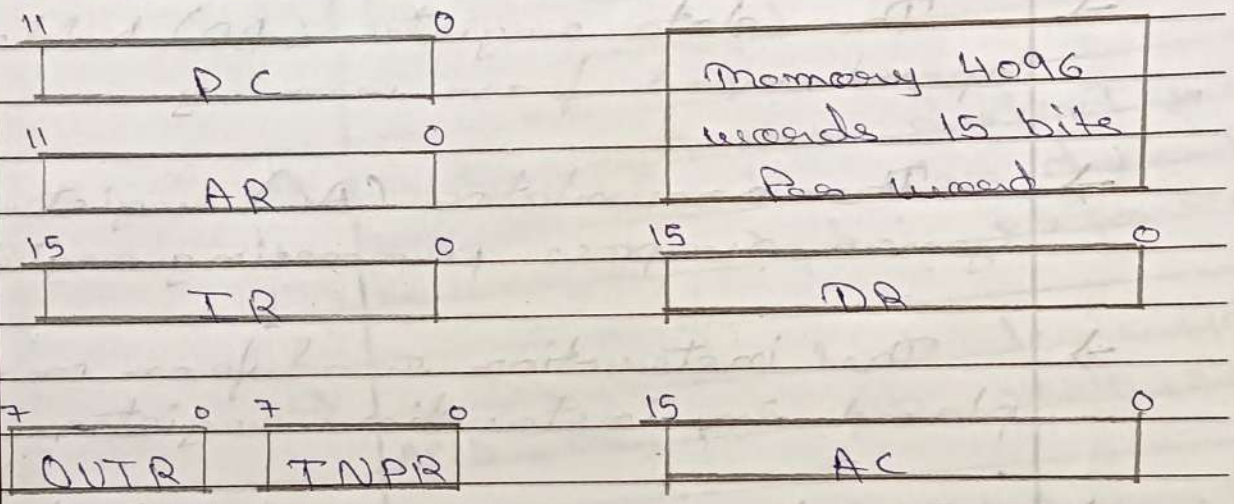
→ The memory address register (AR) base 12 bits Since this width of memory address.

→ The Program Counter (PC) also is 12 bits & it holds adress of next instruction to read from memory after Current instruction executed.

→ The input register (INPR) carries 8 bit.

* character from input device.

→ The output register (OUTR) holds 8 bit character for output device.



Q8] Explain in brief about digital logic System used in Computer organization.

→ The logic gates are the main structure part of digital System.

→ Logic Gates are block of hardware that produces Signals of binary. 1 or 0 when input logic required are Satisfied.

→ Each gate has distinct graph Symbol and its operation can described by means of algebraic expressions.

→ The seven basic logic gates includes AND, OR, XOR, NOT, NAND, NOR and XNOR

→ The relationship between the input-output binary Variables For each gate can represented in tabular Form by a truth table.

→ Each gate has one or two binary input Variables designated by A & B and one binary output Variable designated by X.

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Date : Page No. : 36

→ The hardware Consite of all the electronic Components & electromech anical devices that Compriss the physical entity of device.

→ The Software of the Computers Consists of the instructions and data that the Computer manipulator to perform various data processing tasks.

→ The memory unit of digital Computer Contains storage for instructions and data.

→ The Random Access memory (RAM) For real time processing of the data.