Bhilai Institute of Technology, Durg

(Department of Computer Science and Engineering)

Computer Architecture and Organisation
Assignment

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1. Difference between hardwired and micro-programmed control unit.
Ans:

S.No.	**Hardwired Control Unit**	**Micro-Programmed control unit**
1	Hardwired control unit generates the control signals needed for the processor using logic circuits	Microprogrammed control unit generates the control signals with the help of micro instructions stored in control memory
2	Hardwired control unit is faster when compared to microprogrammed control unit as the required control signals are generated with the help of hardwares	This is slower than the other as micro instructions are used for generating signals here
3	Difficult to modify as the control signals that need to be generated are hard wired	Easy to modify as the modification need to be done only at the instruction level
4	More costlier as everything has to be realized in terms of logic gates	Less costlier than hardwired control as only micro instructions are used for generating control signals
5	It cannot handle complex instructions as the circuit design for it becomes complex	It can handle complex instructions
6	Only limited number of instructions are used due to the hardware implementation	Control signals for many instructions can be generated
7	Used in computer that makes use of Reduced Instruction Set Computers(RISC)	Used in computers that make use of Complex Instruction Set Computers(CISC)

2. Divide 21 and 3 using non-restoring division method.
Ans:
$Dividend = 21 = (10101)_2 = Q$
$Divisor = 3 = (000011)_2 = B$
$B \xrightarrow{\text{2'S}} (111101)_2$
count = 5

A	**Q**	**Count**	**Action**
000000	10101	5	initialize
000001	0101□		shift left
111101	0101□		A$\not<$0
			A=A+$\overline{B}$+1
111110	0101$\boxed{0}$		A $<$ 0 ,
			Q $\leftarrow$ 0
111110	01010	4	count–
111100	1010□		shift left
000011	1010□		A $<$ 0 ,
			A+B
111111	1010$\boxed{0}$		A $<$ 0 ,
			Q $\leftarrow$ 0
111111	10100	3	count–
111111	0100□		shift left
000011	0100□		A $<$ 0 ,
			A+B
1000010	0100$\boxed{1}$		A $\not<$ 0 ,
			Q $\leftarrow$ 1
000010	01001	2	count–
000100	1001□		shift left
111101	1001□		A$\not<$0
			A=A+$\overline{B}$+1
1000001	1001$\boxed{1}$		A $\not<$ 0 ,
			Q $\leftarrow$ 1
000001	10011	1	count–
000011	0011□		shift left
1111101	0011□		A$\not<$0
			A=A+$\overline{B}$+1
1000000	0011$\boxed{1}$		A $\not<$ 0 ,
			Q $\leftarrow$ 0
000000	00111	0	count– ,
			count =0
000111	00111		A=A+B

Result : 000111

3. Perform -8 * -6 using Booth's multiplication technique.

Ans:

$BR = -8 = (11000)_2 \xrightarrow{\text{2'S}} (11000)_2$

$QR = -6 = (1110)_2 \xrightarrow{\text{2'S}} (11010)_2$

$BR \xrightarrow{\overline{BR}+1} (01000)_2$

SC = 5

AC	**QR**	Q_{n+1}	**SC**	**Action**
00000 ↘	11010 ↘	0	5	$Q_nQ_{n+1} = 00$
00000	01101	0		ASR
00000	01101	0	4	$SC \leftarrow SC - 1$
00000	01101	0		$Q_nQ_{n+1} = 10$
01000 ↘	01101 ↘	0		$AC \leftarrow AC + \overline{BR} + 1$
00100	00110	1		ASR
00100	00110	1	3	$SC \leftarrow SC - 1$
00100	00110	1		$Q_nQ_{n+1} = 01$
11100 ↘	00110 ↘	1		$AC \leftarrow AC + BR$
11110	00011	0		ASR
11110	00011	0	2	$SC \leftarrow SC - 1$
11110	00011	0		$Q_nQ_{n+1} = 10$
00110 ↘	00011 ↘	1		$AC \leftarrow AC + \overline{BR} + 1$
00011	10001	1		ASR
00011	00001	1	1	$SC \leftarrow SC - 1$
00011 ↘	00001 ↘	1		$Q_nQ_{n+1} = 11$
00001	10000	1		ASR
00001	10000	1	0	$SC \leftarrow SC - 1$

Result : 0000110000