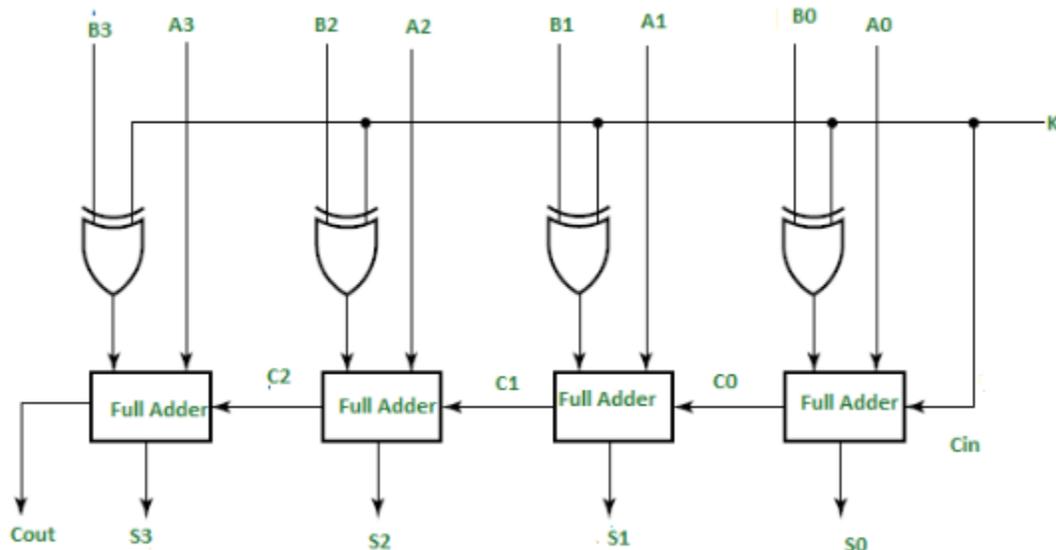|	
Course: Digital Engineering **Semester**: 1ˢᵗ term 2025/2026.	**Lecturers**: Dr. Osama Elnahas, Dr. Dina Abdelhafiz, Dr. Bassant Tolba, Dr. Radwa Rady **Assistant**: Eng. Rania Helal, Eng. Assma, Eng. Israa Mohsen, Eng. Ahmed Kamel, Eng. Belal,
DE ASSIGNMENT 4	

Question 1: Full Adder and Subtraction

There is a control line K (M in your slides) that holds a binary value of either 0 or 1 which determines that the operation is carried out is addition or subtraction.

M = 0 → Perform A + B

M = 1 → Perform A – B using 2's complement

Assume that we have two 3-bit numbers and feed them in Full-Adder as an input.
Find the output sum (s3,s2,s1,s0) and cout for the following:

- M=0 , A=100 , B=011
- M=1 , A=100, B=011
- M=0 , A=111 , B=111
- M=1 , A=111 , B=111
- M=0 , A=101 , B=101
- M=1 , A=101 , B=101

Question 2:

1. A Half Adder adds two:
   A) 3-bit numbers   B) 2 single bits   C) Signed bits   D) Hex values

2. The sum output of a Half Adder is given by:
   A) A·B   B) A + B   C) A $\oplus$ B   D) A $\odot$ B

3. The carry of a Half Adder is:
   A) A + B   B) A $\oplus$ B   C) A′B   D) AB

4. A Half Adder does not handle:
   A) Carry-in   B) Carry-out   C) Sum   D) XOR

5. Logic gates required to build a Half Adder:
   A) XOR + AND   B) OR + NOR   C) XOR + NAND   D) Only XOR

6. If A=1, B=1 → Sum=?
   A) 0   B) 1   C) Undefined   D) X

7. If A=0, B=1 → Carry=?
   A) 0   B) 1   C) X   D) Cannot determine

8. Half Adder is used in:
   A) ALU   B) Full Adder   C) Multipliers   D) All of these

9. A Full Adder adds:
   A) 2 inputs   B) 3 inputs (A, B, Cin)   C) 4 inputs   D) 1 input

10. Full Adder sum expression:
    A) A$\oplus$B$\oplus$Cin   B) AB+Cin   C) A+B   D) A$\oplus$B

11. Carry-out of Full Adder:
    A) AB + BCin + ACin   B) A$\oplus$B   C) A′B   D) Cin′A

12. Full Adder can be built using:
    A) 2 Half Adders + OR   B) 3 XOR gates only   C) 1 NAND   D) 1 NOR

13. For A=1, B=1, Cin=1 → Sum=?
    A) 1   B) 0   C) X   D) 3

14. Same inputs → Carry-out=?
    A) 0   B) 1   C) Undefined   D) X

15. A chain of Full Adders creates a:
    A) Decoder   B) Ripple Adder   C) Encoder   D) Comparator

16. A 4-bit ripple adder uses:
    A) 4 Full Adders   B) 8 Full Adders   C) 2 Half Adders   D) 1 MUX

17. A multiplexer selects:
    A) Multiple outputs → one input   B) One input → many outputs   C) Many inputs
→ one output   D) None

18. A 4-to-1 MUX has:
    A) 2 select lines   B) 4 select lines   C) 1 select line   D) 3 select lines

19. 8-to-1 MUX has:
    A) 4 select lines   B) 2   C) 3   D) 1

20. MUX is also called:
    A) Selector   B) Distributor   C) Decoder   D) Comparator

21. The output equation for a 4:1 MUX:
    A) $S + D0$ B) $S'D0 + S\,D1$ C) $A + B + C$ D) none

22. MUX is used for:
    A) Data routing   B) Arithmetic   C) Memory   D) Power control

23. 2-to-1 MUX selects:
    A) 1 of 2 inputs   B) 2 of 4   C) 1 of 4   D) 4 of 1

24. Select lines determine:
    A) Which input appears at output
    B) Voltage levels
    C) Speed
    D) Fan-out

25. MUX is similar to:
    A) Switch   B) ALU   C) Counter   D) Comparator

26. A MUX implements Boolean functions by:
    A) Forcing outputs to 0
    B) Selecting minterms
    C) Selecting memory

27. A 16-to-1 MUX needs:
    A) 2 selects   B) 4 selects   C) 3   D) 5

28. MUX helps reduce:
   A) Wiring complexity   B) Memory   C) Power   D) Noise only

29. A DEMUX performs:
   A) Many inputs → one output
   B) One input → many outputs
   C) Many → many
   D) None

30. 1-to-4 DEMUX uses:
   A) 4 select lines   B) 2 select lines   C) 3   D) 1

31. DEMUX is used for:
   A) Data distribution   B) Encoding only   C) Memory addressing   D) Both A & C

32. A DEMUX is also called:
   A) Distributor   B) Selector   C) Inverter   D) Adder

33. 1-to-8 DEMUX has:
   A) 1 input, 3 selects, 8 outputs
   B) 8 inputs, 1 output
   C) 3 inputs, 8 selects
   D) None

34. DEMUX sends the input to:
   A) All outputs   B) A selected output only   C) No outputs   D) 2 outputs

35. DEMUX is used in:
   A) Communication systems
   B) Encoders
   C) Comparators
   D) Adders only

36. Select lines choose:
   A) Which output receives data   B) Speed   C) Voltage   D) None

37. A DEMUX is the opposite of:
   A) MUX   B) Counter   C) Flip-flop   D) Encoder

38. DEMUX helps implement:
   A) Decoders
   B) Adder
   C) Comparator
   D) ALU