Practical 7: To Design and Set Up the Following Circuit Using IC 7483

i) 4-bit Binary Parallel Adder
ii) 4-bit Binary Parallel Subtractor

Aim

To design and implement:

1. A **4-bit binary parallel adder** using IC 7483.

2. A **4-bit binary parallel subtractor** using the same IC by using 2's complement method.

Apparatus Required

- IC 7483 (4-bit binary full adder IC)
- Breadboard
- Connecting wires
- DC power supply (+5V)
- Toggle switches or input pins (for A and B inputs)
- LEDs / Seven segment / indicators (for sum/difference & carry/borrow)
- Resistors (for LEDs, if needed)

Theory

1. IC 7483 – 4-bit Binary Full Adder

IC 7483 is a **4-bit binary parallel adder**.
It can add two 4-bit binary numbers along with a carry input.

- **Inputs:**
    - A0, A1, A2, A3 → 4-bit input A
    - B0, B1, B2, B3 → 4-bit input B
    - Cin → Carry input (C0)
- **Outputs:**
    - S0, S1, S2, S3 → 4-bit sum output
    - Cout → Final carry output

It basically performs:

A + B + Cin → Sum + Carry

All four bits are added **simultaneously (in parallel)**, so it is called a **4-bit parallel adder**.

2. 4-bit Binary Parallel Adder

We want to add two 4-bit numbers:

A = A3 A2 A1 A0
B = B3 B2 B1 B0

Output:

Sum = S3 S2 S1 S0
Carry-out = Cout

If Cin = 0, IC adds only A and B.
If Cin = 1, then it adds A + B + 1.

Example:
Let A = 0101 (5), B = 0011 (3)
Then A + B = 1000 (8)

3. 4-bit Binary Parallel Subtractor Using IC 7483

Subtraction can be performed using **2's complement method**:

A − B = A + (2's complement of B)

2's complement of B is:

1. 1's complement: invert all bits of B → B'
2. Add 1: B' + 1

So,

A − B = A + B' + 1

IC 7483 already adds 3 things: A, B, Cin
So we can do:

- Give **A** normally to A0–A3
- Give **B'** (inverted B) to B0–B3
- Set **Cin = 1**

Then:

Output = A + B' + 1 = A − B

Iska matlab: **same IC 7483 se subtractor bhi ban sakta hai**, bus B ko invert karke aur Cin = 1 rakhna padta hai.

Circuit Connections

1. For 4-bit Binary Parallel Adder

1. Connect **+5V** to Vcc pin of IC 7483.
2. Connect **GND** to ground pin of IC 7483.
3. Connect A0–A3 to 4 input switches (for A).
4. Connect B0–B3 to 4 input switches (for B).
5. Connect **Cin = 0** (to ground).
6. Connect outputs S0–S3 to LEDs or display.
7. Connect Cout to an LED to show final carry.

2. For 4-bit Binary Parallel Subtractor

1. Again connect +5V and GND to IC 7483.
2. Inputs A0–A3 = Minuend (A).
3. Inputs B0–B3 = 2's complement of Subtrahend (B).
    - Practically:
        - Pass B bits through NOT gates/inverters to get B'
        - Connect B' to B0–B3
4. Set **Cin = 1** to add the +1 part of 2's complement.
5. Outputs S0–S3 now represent **Difference (A − B)**.
6. Cout bit can be used to analyze overflow or borrow concept (depending on design convention).

Truth Table (Sample Values)

1. For 4-bit Binary Adder (Example Cases)

A3 A2 A1 A0	B3 B2 B1 B0	Cin	Binary A	Binary B	Sum (S3 S2 S1 S0)	Cout
0 0 0 1	0 0 0 1	0	1	1	0 0 1 0 (2)	0
0 1 0 1	0 0 1 1	0	5	3	1 0 0 0 (8)	0
1 0 0 1	0 1 1 1	0	9	7	0 0 0 0 (16)	1

2. For 4-bit Binary Subtractor (Using 2's Complement)

Example: **A − B**

1. Let A = 0101 (5), B = 0011 (3)

- B = 0011
- B' = 1100 (1's complement)
- B' + 1 = 1101 (2's complement)

So IC does:

0101 + 1101 = 10010

We take 4 LSB bits → 0010 (2)
So result = 2 = 5 − 3

A (A3 A2 A1 A0)	B (B3 B2 B1 B0)	Operation	Result (Diff)

0 1 0 1 (5)	0 0 1 1 (3)	5 − 3 using 2's comp	0 0 1 0 (2)

You don't need full long 16-row table in copy, bas thoda sample values likhna enough hota hai practical file ke liye.

Procedure

For 4-bit Adder:

1. Place IC 7483 on breadboard.
2. Connect Vcc to +5V and GND to ground.
3. Connect A0–A3 and B0–B3 pins to input switches.
4. Set Cin = 0 for simple addition.
5. Connect S0–S3 and Cout to LEDs.
6. Apply different 4-bit inputs for A and B.
7. Note the LED pattern and convert it to binary/decimal.
8. Verify that the output matches A + B.

For 4-bit Subtractor:

1. Keep same IC 7483 on breadboard.
2. Connect A0–A3 as minuend (A).
3. Pass B inputs through NOT gates to form B', then connect B' to B0–B3.
4. Set Cin = 1 (to complete 2's complement = B' + 1).

5. Apply different values of A and B.
6. Note outputs S0–S3 as **difference** (A − B).
7. Confirm the result by manual subtraction.

Observations

- For each set of inputs (A, B), note:
    - A (binary & decimal)
    - B (binary & decimal)
    - Sum or Difference (binary & decimal)
    - Carry or Borrow indication (if used)

(Apni copy mein 4–6 example rows bana lena, bas.)