**PART A**

(PART A: TO BE REFFERED BY STUDENTS)

**Experiment No.09**

**A.1—Aim:**

**To convert IP Address to Binary and vice versa and convert them into classes.**

**A.2--- Prerequisite:**

Network Layer , IP Address , Decimal to Binary Conversion

**A.3--- Outcome:**

After successful completion of this experiment students will be able to:

* Understand the fields in IP address
* To convert IP address into binary

**A.4--- Theory:**

Decimal to binary conversion is an important task to understand in IP addressing and Subnetting. IP addressing is a core functionality of networking today. The knowledge of how to assign an IP address, or determine the network or host ID via a subnet, is vital to any good network engineer. Having a good, solid understanding of the simple things makes more complex tasks easier. Here are steps on how to convert a decimal IP address to its binary form, without memorization.

1. The first, and probably most important step, is to put down this row of values:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |

1. In order to remember these values start with the number 1, go from right to left, and double that number seven times. For example, start with 1 on the right side. For your next number, double the 1 (1 x 2 = 2). So, 2 is your next number (remembering to go from right to left). For your third number, double the 2 (2 x 2 = 4); to continue the sequence, double the 4 (4 x 2 = 8). Repeat this process until you’ve doubled your original number, seven times. The key to this is that every single one of the values we put in that row are going to have either number 1 or number 0 assigned to it. To convert the IP address we will take that string of numbers and start from left to right this time. For each value we ask this question: “Can I subtract this value from the decimal remaining?” If the answer is “NO” then you put a “0” under the binary value, and if the answer is “YES” then you put “1” there.
2. We take the IP address: 154.31.16.13 and start with the first part, which is 154.

Question: Can I subtract 128 from 154? Answer: YES. So we assign 1 to 128.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 |  |  |  |  |  |  |  |

Question: Can I subtract 64 from 26? Answer: NO. So we assign 0 to 64.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 |  |  |  |  |  |  |

Question: Can I subtract 32 from 26? Answer: NO. So we assign 0 to 32.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 |  |  |  |  |  |

Question: Can I subtract 16 from 26? Answer: YES. So we assign 1 to 16.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 1 |  |  |  |  |

That will give us a remainder of 10. (26-16=10). Question: Can I subtract 8 from 10? Answer: YES. So we assign 1 to 8.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 1 | 1 |  |  |  |

That will give us a remainder of 2. (10-8=2). Question: Can I subtract 4 from 2? Answer: NO. So we assign 0 to 4.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 |  |  |

Question: can I subtract 2 from 2? Answer: YES. So we assign 1 to 2.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 | 1 |  |

That will give us a remainder of 0. So for the rest of the values in our row, we can assign 0.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |

So now we know that a decimal number 154 is 10011010 converted to binary form. To double check, we take the values assigned with 1 and add them together: 128+16+8+2=154

1. Our next number in the IP address is: 31. So we start with a question from step 2 again

Can I subtract 128 from 31?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 |  |  |  |  |  |  |  |

Can I subtract 64 from 31?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 |  |  |  |  |  |  |

Can I subtract 32 from 31?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 |  |  |  |  |  |

Can I subtract 16 from 31?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 1 |  |  |  |  |

Can I subtract 8 from 15 (remember, it’s the remainder)?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 1 | 1 |  |  |  |

Can I subtract 4 from 7?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 |  |  |

Can I subtract 2 from 3?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 |  |

Can I subtract 1 from 1?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |

So the decimal number 31 is 00011111 converted to binary form. To double check: 16+8+4+2+1=31

1. Next number is 16. I will perform the conversion in one step now.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

1. So the decimal number 16 is 00010000 converted to binary form.
2. Next number is 13.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |

1. So the decimal number 13 is 00001101 in binary form. To double check: 8+4+1=13

So the IP address of 154.31.16.13 has its binary form equivalent of:

10011010.00011111.00010000.00001101

**A.5--- Tasks:**

1. Accept IP address from User.
2. Convert IP address according to Theory Section.
3. Observe the output and complete PART B of lab manual.
4. Save and close the file and name it as **EXP9\_ your Roll no**