Program – 12:

Aim: Write a program for congestion control using Leaky bucket algorithm.

Program:

```
def leaky_bucket(bucket_capacity, output_rate, incoming_packets):
    stored = 0  # current number of packets in the bucket

    # Print Table Header
    print(f"{'Time (s)':<12}{'Incoming Packets':<18}{'Bucket State (Before Leak)':<24}{'Dropped
Packets':<15}{'Transmitted Packets':<20}{'Packets Left in Bucket'}")
    print("="*90)

    for time, packets in enumerate(incoming_packets, start=1):
        # Handle overflow: if incoming packets cause bucket overflow
        if packets + stored > bucket_capacity:
            dropped = (packets + stored) - bucket_capacity
            stored = bucket_capacity
        else:
            dropped = 0
            stored += packets

        # Transmit packets at output rate
        transmitted = min(stored, output_rate)
        stored -= transmitted

        # Print row for the table
        print(f"{time:<12}{packets:<18}{stored +
transmitted:<24}{dropped:<15}{transmitted:<20}{stored}")

    # Empty remaining packets in the bucket after incoming packets are done
    while stored > 0:
        time += 1
        transmitted = min(stored, output_rate)
        stored -= transmitted

        # Print row for remaining packets
        print(f"{time:<12}{'--':<18}{stored + transmitted:<24}{'--':<15}{transmitted:<20}{stored}")

    print("\nAll packets transmitted successfully.")

# ---- Main Program ----
if __name__ == "__main__":
    bucket_capacity = int(input("Enter bucket capacity (packets): "))
    output_rate = int(input("Enter output rate (packets/sec): "))

    n = int(input("Enter number of incoming packet sets: "))
    incoming_packets = []

    for i in range(n):
        packets = int(input(f"Packets arriving at time {i + 1}: "))
        incoming_packets.append(packets)
```

leaky_bucket(bucket_capacity, output_rate, incoming_packets)

Output:

```
Enter bucket capacity (packets): 5
Enter output rate (packets/sec): 1
Enter number of incoming packet sets: 5
Packets arriving at time 1: 6
Packets arriving at time 2: 4
Packets arriving at time 3: 8
Packets arriving at time 4: 1
Packets arriving at time 5: 0
Time (s)    Incoming Packets  Bucket State (Before Leak)Dropped PacketsTransmitted Packets Packets Left in Bucket
================================================================================================
1           6                 5                       1               1                   4
2           4                 5                       3               1                   4
3           8                 5                       7               1                   4
4           1                 5                       0               1                   4
5           0                 4                       0               1                   3
6           --                3                       --              1                   2
7           --                2                       --              1                   1
8           --                1                       --              1                   0

All packets transmitted successfully.
```