LAB WEEK 10

1. **Write a program for error detecting code using CRC-CCITT (16 bits).**

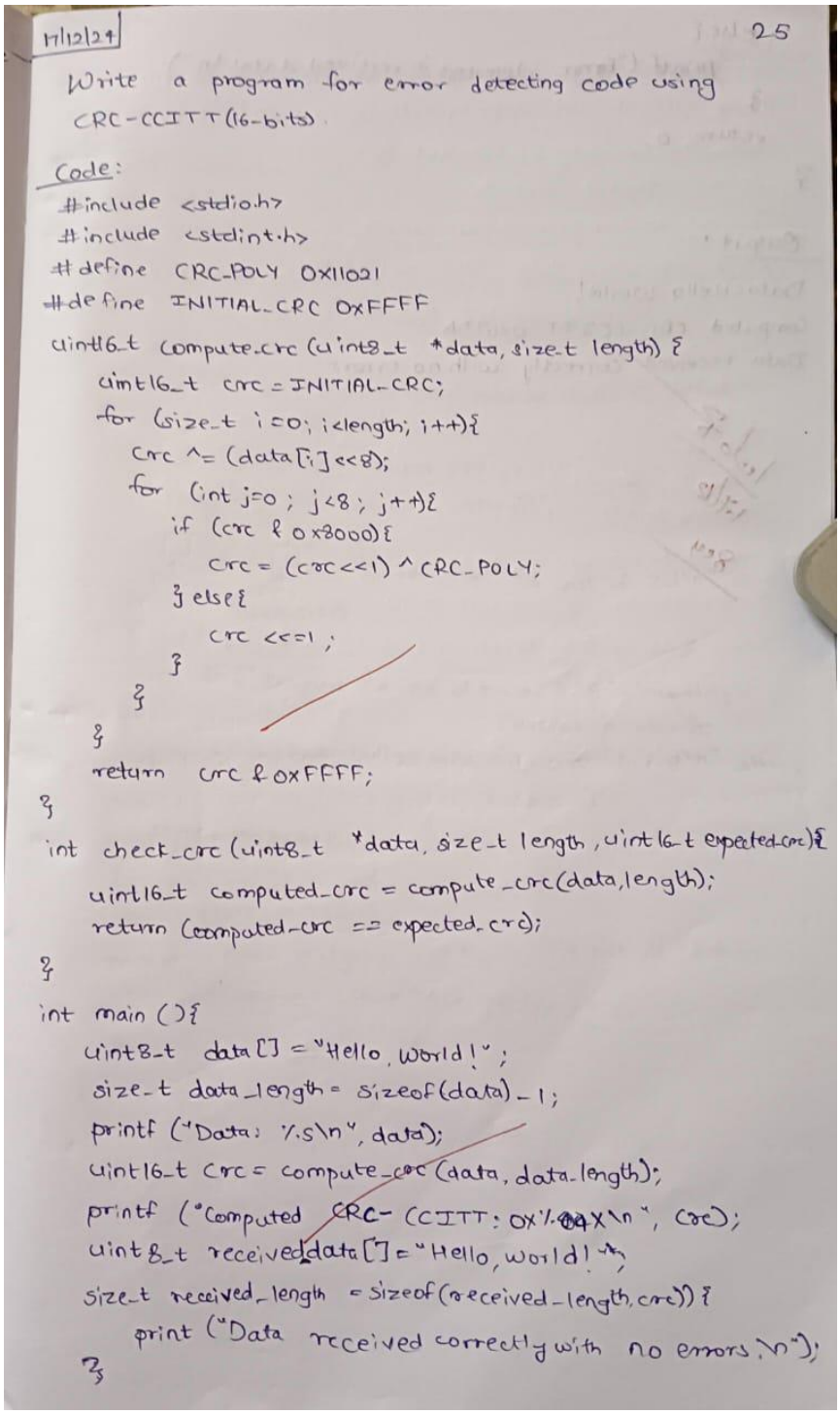
Code:

```
#include <stdio.h>
#include <stdint.h>
#define CRC_POLY 0x11021
#define INITIAL_CRC 0xFFFF

uint16_t compute_crc(uint8_t *data, size_t length) {
    uint16_t crc = INITIAL_CRC;
    for (size_t i = 0; i < length; i++) {
        crc ^= (data[i] << 8);
        for (int j = 0; j < 8; j++) {
            if (crc & 0x8000) {
                crc = (crc << 1) ^ CRC_POLY;
            } else {
                crc <<= 1;
            }
        }
    }
    return crc & 0xFFFF;
}

int check_crc(uint8_t *data, size_t length, uint16_t expected_crc) {
    uint16_t computed_crc = compute_crc(data, length);
    return (computed_crc == expected_crc);
}

int main() {
    uint8_t data[] = "Hello, World!";
    size_t data_length = sizeof(data) - 1;
    printf("Data: %s\n", data);
    uint16_t crc = compute_crc(data, data_length);
    printf("Computed CRC-CCITT: 0x%04X\n", crc);
    uint8_t received_data[] = "Hello, World!";
    size_t received_length = sizeof(received_data) - 1;
    if (check_crc(received_data, received_length, crc)) {
        printf("Data received correctly with no errors.\n");
    } else {
        printf("Error detected in received data!\n");
    }
    return 0;
}
```

Output:

```
Data: Hello, World!
Computed CRC-CCITT: 0x67DA
Data received correctly with no errors.
```

Figure 1: Output of CRC-CCIT



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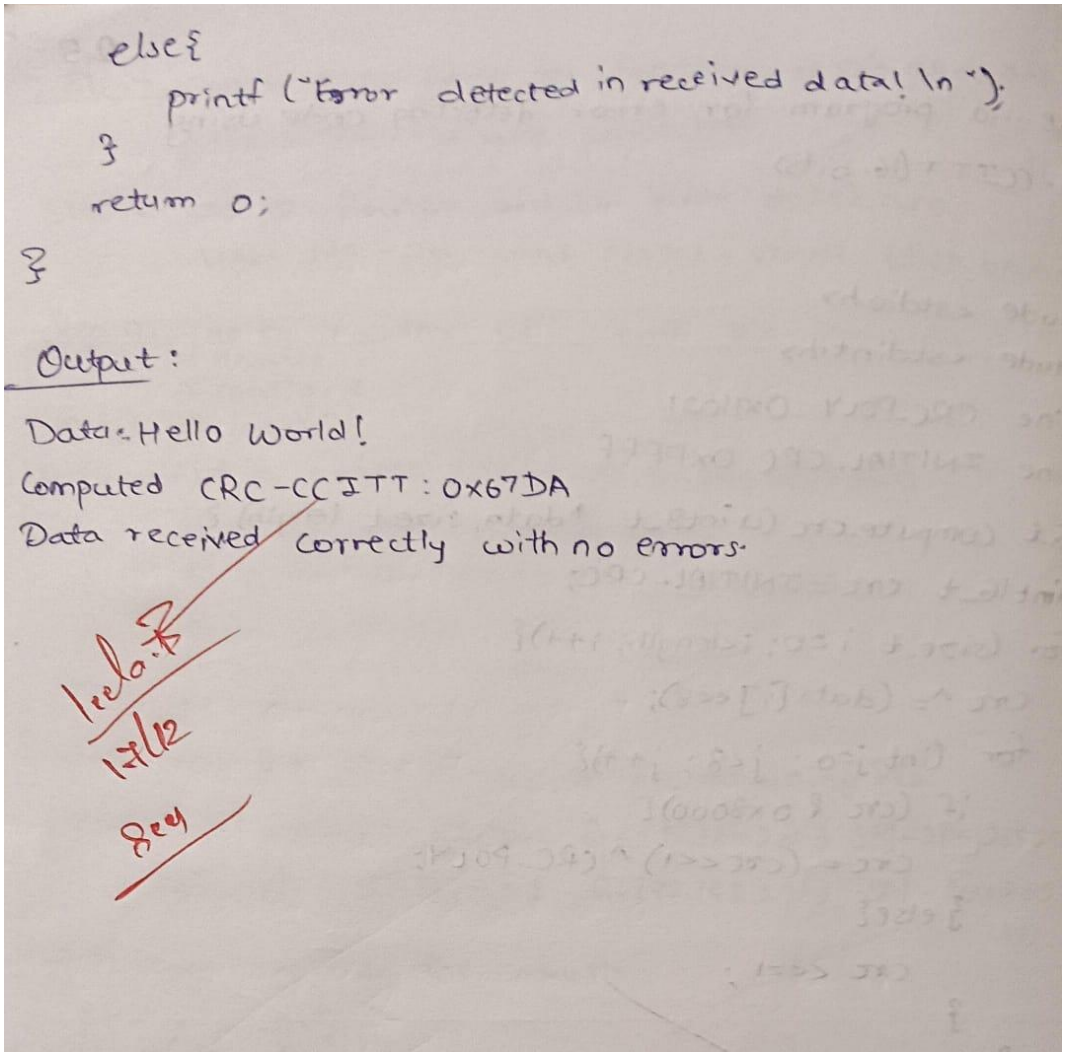
Write a program for error detecting code using CRC-CCITT (16-bits)

Code:

```
#include <stdio.h>
#include <stdint.h>
#define CRC_POLY 0x11021
#define INITIAL_CRC 0xFFFF
uint16_t compute_crc(uint8_t *data, size_t length) {
    uint16_t crc = INITIAL_CRC;
    for (size_t i=0; i<length; i++){
        crc ^= (data[i]<<8);
        for (int j=0; j<8; j++){
            if (crc & 0x8000){
                crc = (crc<<1) ^ CRC_POLY;
            } else{
                crc <<=1;
            }
        }
    }
    return crc & 0xFFFF;
}
int check_crc(uint8_t *data, size_t length, uint16_t expected_crc){
    uint16_t computed_crc = compute_crc(data,length);
    return (computed_crc == expected_crc);
}
int main (){
    uint8_t data[] = "Hello, World!";
    size_t data_length = sizeof(data) - 1;
    printf ("Data: %s\n", data);
    uint16_t crc = compute_crc(data, data_length);
    printf ("Computed CRC-CCITT: 0x%04X\n", crc);
    uint8_t received_data[] = "Hello, World!";
    size_t received_length = sizeof(received_length, crc)) {
        print ("Data received correctly with no errors.\n");
}
```

Figure 2: Observation Book 1



```
    else{
        printf ("Error detected in received data!\n");
    }
    return 0;
}
```

Output:

```
Data: Hello World!
Computed CRC-CCITT: 0x67DA
Data received correctly with no errors.
```

Figure 3: Observation Book 3

2. Write a program for congestion control using Leaky Bucket algorithm

Code:

```
#include<stdio.h>

int main(){
   int incoming, outgoing, buck_size, n, store = 0;
   printf("Enter bucket size, outgoing rate and no of inputs: ");
   scanf("%d %d %d", &buck_size, &outgoing, &n);

   while (n != 0) {
      printf("Enter the incoming packet size : ");
      scanf("%d", &incoming);
      printf("Incoming packet size %d\n", incoming);
      if (incoming <= (buck_size - store)){
         store += incoming;
         printf("Bucket buffer size %d out of %d\n", store, buck_size);
      } else {
         printf("Dropped %d no of packets\n", incoming - (buck_size - store));
         printf("Bucket buffer size %d out of %d\n", store, buck_size);
         store = buck_size;
      }
      store = store - outgoing;
      printf("After outgoing %d bytes left out of %d in buffer\n", store, buck_size);
      n--;
   }
}
```

Output:

```
Enter bucket size, outgoing rate and no of inputs: 10 3 3
Enter the incoming packet size : 5
Incoming packet size 5
Bucket buffer size 5 out of 10
After outgoing 2 bytes left out of 10 in buffer
Enter the incoming packet size : 5
Incoming packet size 5
Bucket buffer size 7 out of 10
After outgoing 4 bytes left out of 10 in buffer
Enter the incoming packet size : 7
Incoming packet size 7
Dropped 1 no of packets
Bucket buffer size 4 out of 10
After outgoing 7 bytes left out of 10 in buffer
```

Figure 4: Output for Leaky Bucket algorithm

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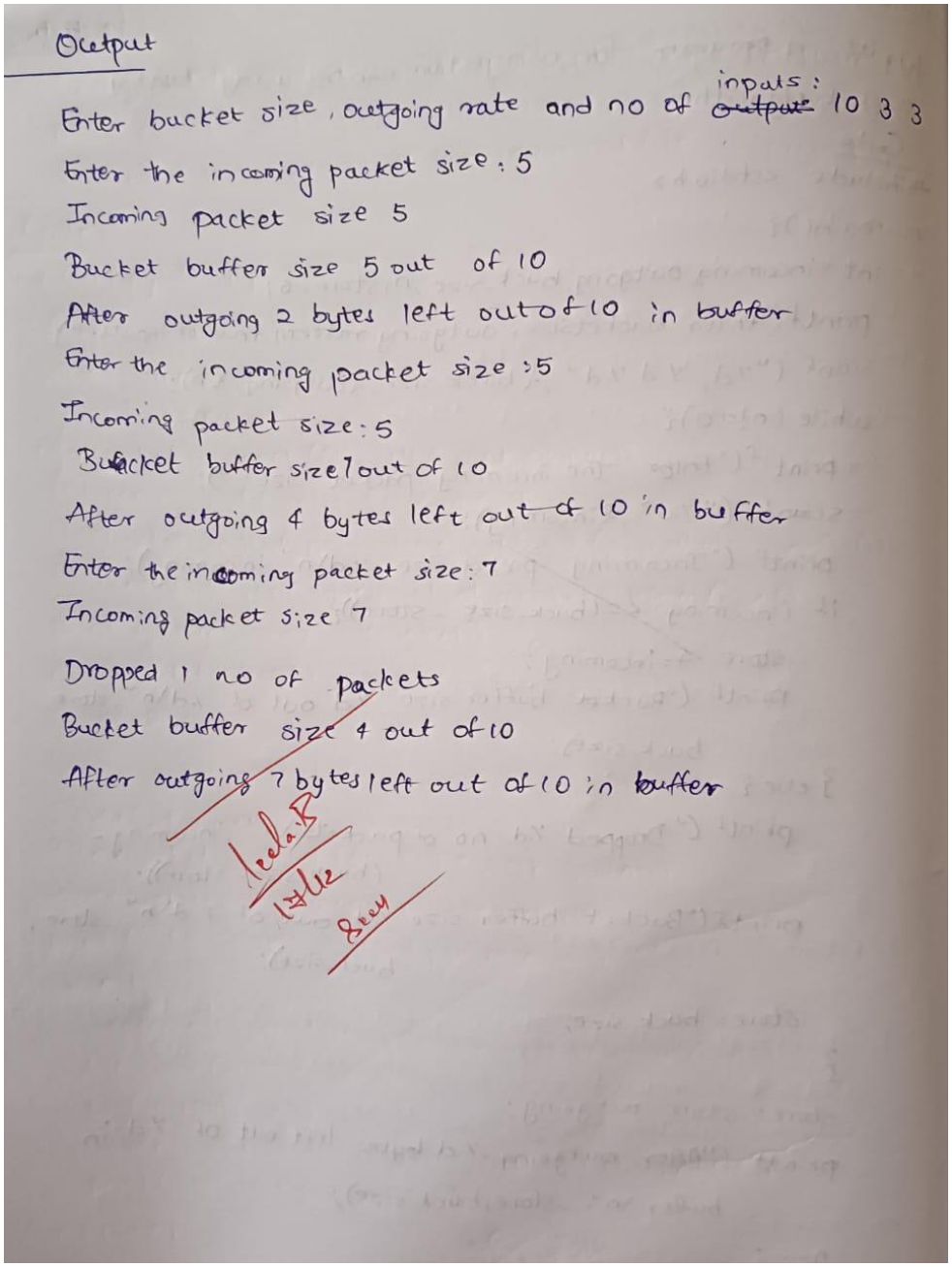
Write a program for congestion control using Leaky Bucket algorithm.

Code

```
#include <stdio.h>
int main(){
    int incoming, outgoing, buck_size, n, store=0;
    printf("Enter bucketsize, outgoing rate and no. of inputs: ");
    scanf ("%d %d %d", &buck_size, &outgoing, &n);
    while (n!=0){
      printf("Enter the incoming packet size: ");
      scanf ("%d", &incoming);
      printf ("Incoming packet size %d\n", incoming);
      if (incoming <= (buck_size - store)){
         store += incoming;
         printf ("Bucket buffer size %d out of %d\n", store,
              buck_size);
      } else {
         printf ("Dropped %d no of packets\n", incoming -
                                   (buck_size - store));
         printf("Bucket buffer size %d out of %d\n", store,
                                   buck_size);
         store = buck_size;
      }
      store = store - outgoing;
      printf ("After outgoing %d bytes left out of %d in
           buffer\n", store, buck_size);
      n--;
    }
}
```

Figure 5: Observation Book 1



Output

Enter bucket size, outgoing rate and no of ~~output~~ inputs: 10 3 3

Enter the incoming packet size: 5

Incoming packet size 5

Bucket buffer size 5 out of 10

After outgoing 2 bytes left out of 10 in buffer

Enter the incoming packet size: 5

Incoming packet size: 5

Bucket buffer size 7 out of 10

After outgoing 4 bytes left out of 10 in buffer

Enter the incoming packet size: 7

Incoming packet size 7

Dropped 1 no of packets

Bucket buffer size 4 out of 10

After outgoing 7 bytes left out of 10 in buffer

Figure 6: Observation Book 2