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Course Code : BCSE308P

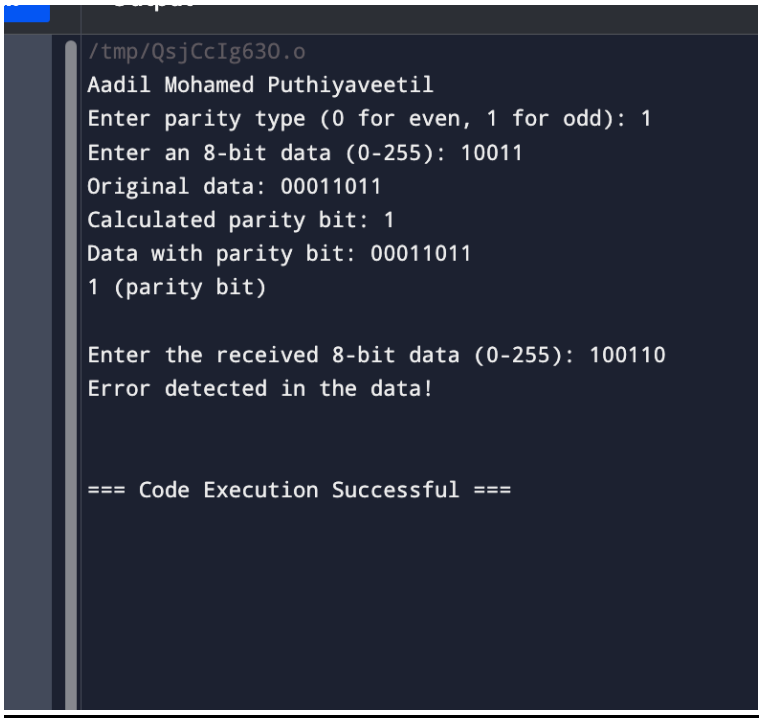
COMPUTER NETWORKS DA-2

Parity bit

```
#include <stdio.h>

int calculate_parity(unsigned char data, int parity_type) {
   int parity = 0;
   while (data) {
      parity ^= (data & 1);
      data >>= 1;
   }
   if (parity_type == 0) {
      return parity;
   } else {
      return !parity;
   }
}

void print_bits(unsigned char byte) {
   for (int i = 7; i >= 0; i--) {
      printf("%d", (byte >> i) & 1);
   }
   printf("\n");
}

int main() {
   unsigned char data;
   int parity_bit;
   int parity_type;
   unsigned char received_data;
   printf("Aadil Mohamed Puthiyaveetil\n");
   printf("Enter parity type (0 for even, 1 for odd): ");
   scanf("%d", &parity_type);

   if (parity_type != 0 && parity_type != 1) {
      printf("Invalid parity type. Exiting.\n");
      return 1;
   }
```

```
    printf("Enter an 8-bit data (0-255): ");
    scanf("%hhu", &data);

    parity_bit = calculate_parity(data, parity_type);

    printf("Original data: ");
    print_bits(data);

    printf("Calculated parity bit: %d\n", parity_bit);

    printf("Data with parity bit: ");
    print_bits(data);
    printf("%d (parity bit)\n", parity_bit);

    printf("\nEnter the received 8-bit data (0-255): ");
    scanf("%hhu", &received_data);

    int received_parity_bit = calculate_parity(received_data, parity_type);

    if (received_parity_bit == parity_bit) {
        printf("No error detected.\n");
    } else {
        printf("Error detected in the data!\n");
    }

    return 0;
}
```

Output



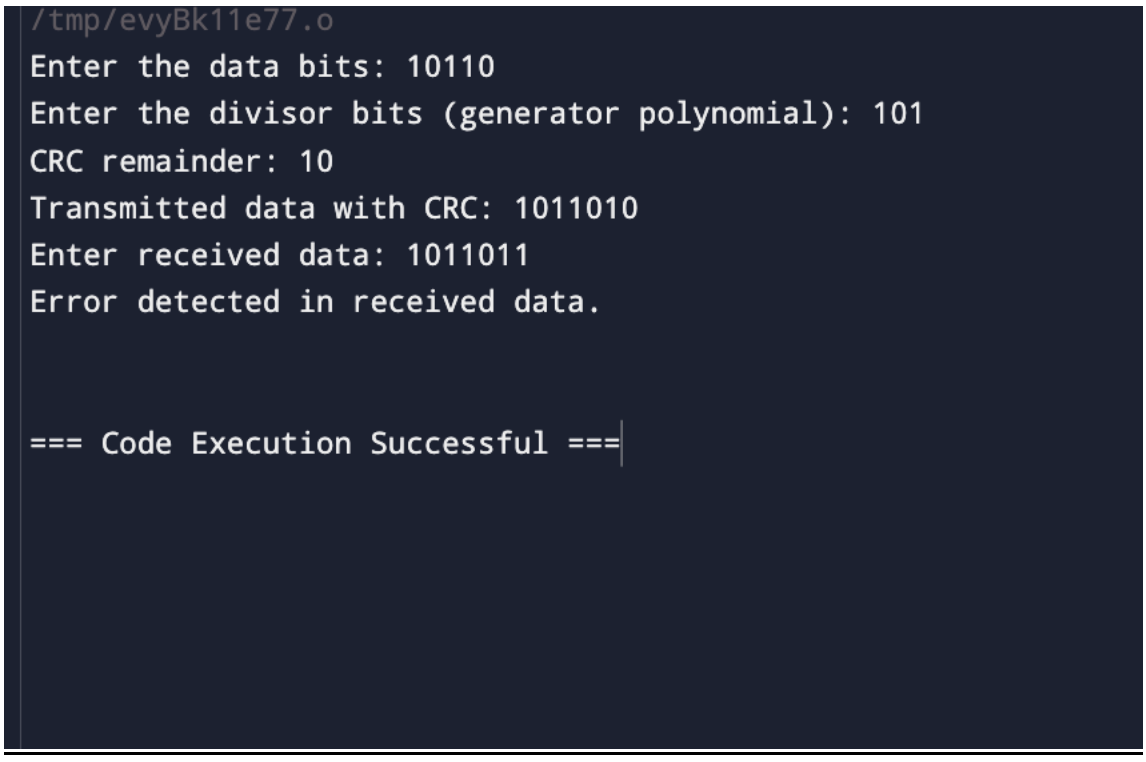
CRC

```
#include <stdio.h>
#include <string.h>
#define MAX 100

void XOR(char dividend[], char divisor[], int n) {
    for (int i = 0; i < n; i++) {
        if (dividend[i] == divisor[i]) {
            dividend[i] = '0';
        } else {
            dividend[i] = '1';
        }
    }
}

void crc(char data[], char divisor[], char remainder[]) {
    int dataLen = strlen(data);
    int divisorLen = strlen(divisor);
    char temp[MAX];
```

```
    strcpy(temp, data);

    for (int i = dataLen; i < dataLen + divisorLen - 1; i++) {
        temp[i] = '0';
    }
    temp[dataLen + divisorLen - 1] = '\0';

    for (int i = 0; i <= dataLen - 1; i++) {
        if (temp[i] == '1') {
            XOR(temp + i, divisor, divisorLen);
        }
    }

    strcpy(remainder, temp + dataLen);
}

int main() {
    char data[MAX], divisor[MAX], transmitted[MAX], remainder[MAX];

    printf("Enter the data bits: ");
    scanf("%s", data);

    printf("Enter the divisor bits (generator polynomial): ");
    scanf("%s", divisor);

    crc(data, divisor, remainder);
    printf("CRC remainder: %s\n", remainder);

    strcpy(transmitted, data);
    strcat(transmitted, remainder);
    printf("Transmitted data with CRC: %s\n", transmitted);

    char received[MAX];
    printf("Enter received data: ");
    scanf("%s", received);

    crc(received, divisor, remainder);

    int error = 0;
    for (int i = 0; i < strlen(divisor) - 1; i++) {
```

```
        if (remainder[i] != '0') {
            error = 1;
            break;
        }
    }

    if (error) {

        printf("Error detected in received data.\n");
    } else {
        printf("No error detected in received data.\n");
    }

    return 0;
}
```

OUTPUT



Hamming Code

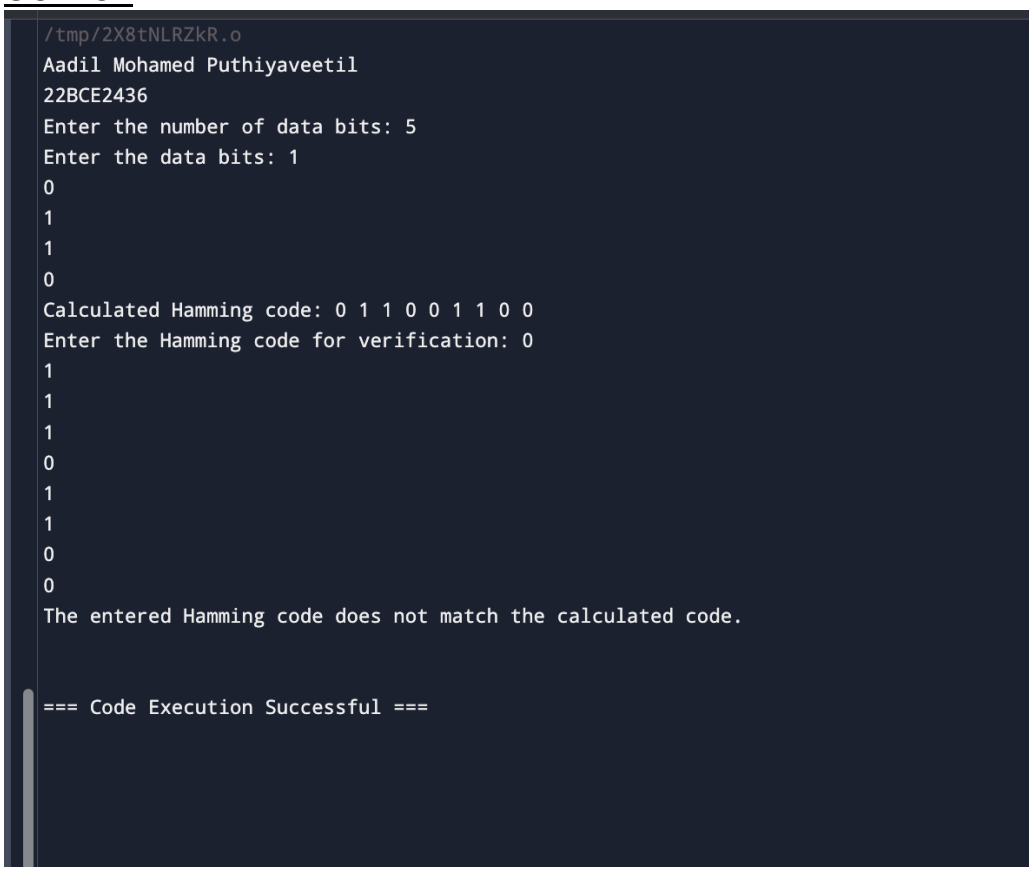
```
#include <stdio.h>
#include <math.h>
```

```
void calculateParityBits(int data[], int n, int hammingCode[]) {
   int r = 0;
   while ((n + r + 1) > pow(2, r)) {
      r++;
   }

   int parityIndex = 0, dataIndex = 0;
   for (int i = 1; i <= n + r; i++) {
      if ((i & (i - 1)) == 0) {
         hammingCode[i - 1] = 0;
      } else {
         hammingCode[i - 1] = data[dataIndex++];
      }
   }

   for (int i = 0; i < r; i++) {
      int parityPos = pow(2, i);
      int count = 0;
      for (int j = parityPos; j <= n + r; j += (2 * parityPos)) {
         for (int k = j; k < j + parityPos && k <= n + r; k++) {
            if (hammingCode[k - 1] == 1) {
               count++;
            }
         }
      }
      hammingCode[parityPos - 1] = count % 2;
   }
}

void printArray(int arr[], int size) {
   for (int i = 0; i < size; i++) {
      printf("%d ", arr[i]);
   }
   printf("\n");
}

int main() {
   int n;
   printf("Aadil Mohamed Puthiyaveetil\n");
```

```
printf("22BCE2436\n");

printf("Enter the number of data bits: ");
scanf("%d", &n);
int data[n];

printf("Enter the data bits: ");
for (int i = 0; i < n; i++) {
   scanf("%d", &data[i]);
}

int r = 0;
while ((n + r + 1) > pow(2, r)) {
   r++;
}

int hammingCode[n + r];
calculateParityBits(data, n, hammingCode);

printf("Calculated Hamming code: ");
printArray(hammingCode, n + r);

int userCode[n + r];
printf("Enter the Hamming code for verification: ");
for (int i = 0; i < n + r; i++) {
   scanf("%d", &userCode[i]);
}

int isMatching = 1;
for (int i = 0; i < n + r; i++) {
   if (userCode[i] != hammingCode[i]) {
      isMatching = 0;
      break;
   }
}

if (isMatching) {
   printf("The entered Hamming code matches the calculated code.\n");
} else {
```

```
        printf("The entered Hamming code does not match the calculated
code.\n");
    }

    return 0;
}
```

OUTPUT



Checksum

```
#include <stdio.h>

int calculateChecksum(int data[], int length) {
   int sum = 0;
   for (int i = 0; i < length; i++) {
      sum += data[i];
      if (sum > 0xFFFF) {
         sum = (sum & 0xFFFF) + (sum >> 16);
      }
   }
   return ~sum & 0xFFFF;
}

int main() {
    printf("Name: Aadil Mohamed\n");
   printf("Reg No: 22BCE2436\n");
   int n;
   printf("Enter the number of data blocks: ");
   scanf("%d", &n);
   int data[n + 1];

   printf("Enter the data blocks (16-bit hexadecimal values, e.g., 0xABCD):\n");
   for (int i = 0; i < n; i++) {
      scanf("%x", &data[i]);
   }

   int checksum = calculateChecksum(data, n);
   printf("Calculated checksum: 0x%X\n", checksum);

   data[n] = checksum;
   printf("Transmitting data with checksum: ");
   for (int i = 0; i <= n; i++) {
      printf("0x%X ", data[i]);
   }
   printf("\n");

   int receivedData[n + 1];
   printf("Enter received data with checksum: ");
```

```
    for (int i = 0; i <= n; i++) {
        scanf("%x", &receivedData[i]);
    }

    int receiverChecksum = calculateChecksum(receivedData, n + 1);
    if (receiverChecksum == 0xFFFF) {
        printf("Data received correctly.\n");
    } else {
        printf("Error detected in data transmission.\n");
    }
```

Output