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|  | **BAHRIA UNIVERSITY,**  **(Karachi Campus)**  *Department of Software Engineering*  **ASSIGNMENT 03 – Fall 2023** |

COURSE TITLE: **Computer Communication & Networks** COURSE CODE: **CEN-223**

Class: **BSE - 5** Shift: **Morning**

Course Instructor: **Dr. Muhammad Hussain** Date: **Dec 11, 2023**

Due Date: **Oct 20, 2023** Marks: **5.0 Marks**

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Through designing find the solution of scenarios given below:

CLO 5

Q.1 Examine a scenario involving a sender (S) and a receiver (R) linked on a network with a one-way latency of 250 milliseconds, a data rate of 32,000 bits per second, and frames of 1,000 bits each. Assume the use of sliding windows with selective repeat. Design the length of the window size for sender S to maximize utilization in this context.

**Solution:**

To determine the window size that maximizes utilization in a scenario with one-way latency, data rate, and frame size, we can use the following formula for calculating the throughput of a network:

Throughput = Window Size/Round Trip Time

Given that the round-trip time (RTT) is 2 one-way latency and the frame size is 1000 bits, we can calculate the round-trip time as follows:

RTT = 2 one-way latency = 2 x 250 milliseconds = 500 milliseconds

Now, let's calculate the throughput:

Throughput = Window Size/RTT

Given that the data rate is 32,000 bits per second, we can express the throughput in terms of the window size:

Throughput = 32,000 x window size/500 milliseconds

To maximize utilization, we aim to maximize the throughput. We can set the derivative of the throughput with respect to the window size to zero and solve for the window size. However, since the window size needs to be an integer, we typically use the "Bandwidth-Delay Product" to set the window size.

BDP = Bandwidth x RTT

In this case:

BDP = Data Rate x RTT = 32,000 bps x 500ms = 16,000 bits

The window size is then given by:

Window Size = BDP\Frame Size

Window Size = 16,000 bits/1000 bits = 16

So, the maximum window size for sender S to maximize utilization in this scenario is 16.

Q. 2 Design a coding strategy with the ability to identify two or less errors in the message given blow:

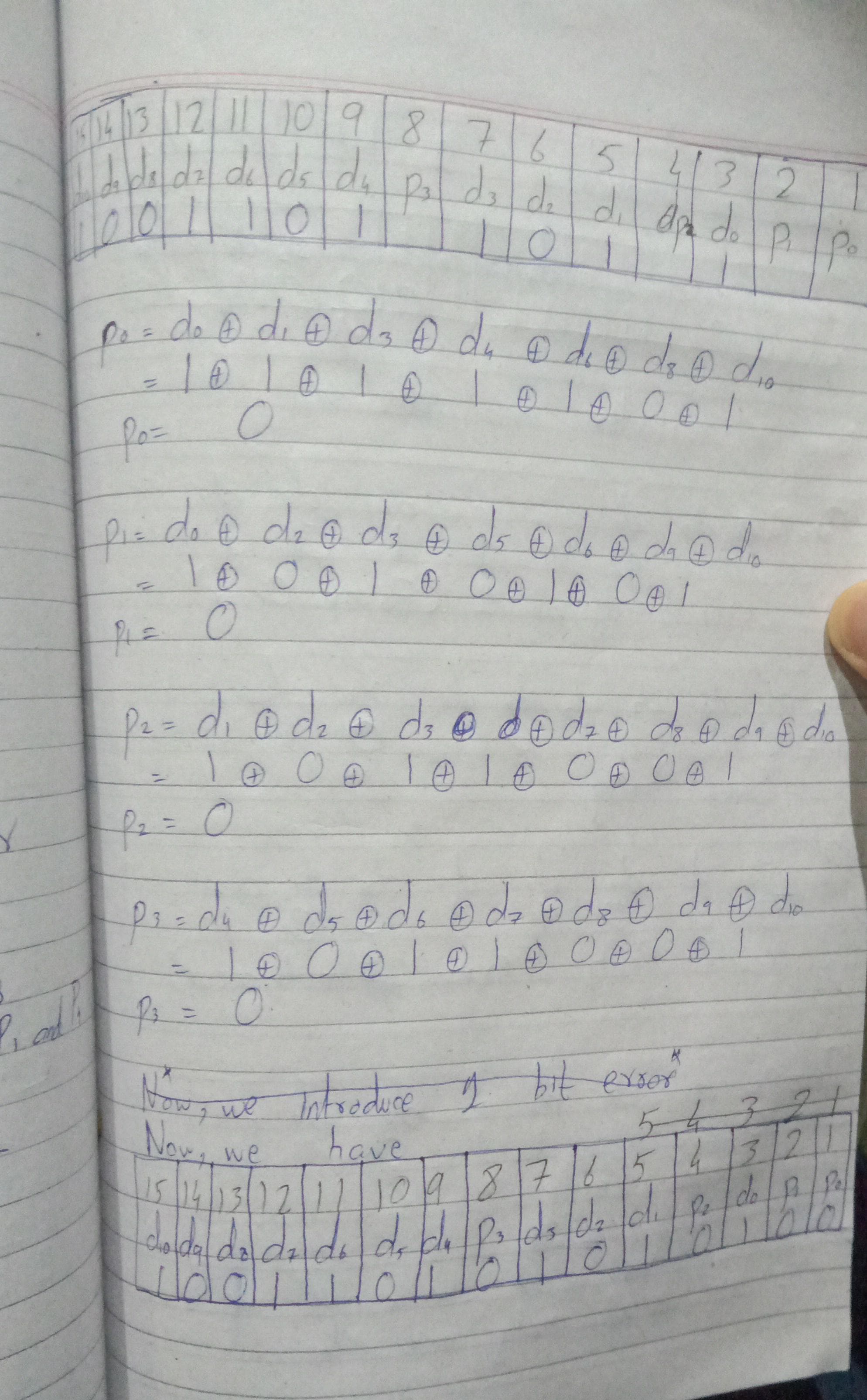
|  |  |
| --- | --- |
| **Message** | **Code** |
| 00 | 00000 |
| 01 | 10110 |
| 10 | 01101 |
| 11 | 11011 |

Identify one of the most efficient schemes in terms of information transmission speed.

Solution:

This scheme can detect up-to two bit error, as any single as double error will result in an invalid codework. The information transmission speed is 2/5 = 0.4 bits/channel use.

Q.3 Create Hamming codes for transmitting 11-bit messages. Begin by designing the Hamming codeword for a specific message, such as 10011011011, by choosing suitable redundancy. Next, introduce a 1-bit error by inverting one message bit within the Hamming codeword. Illustrate the recipient's process of utilizing the check bits to identify and correct the inverted bit, demonstrating the error correction procedure.



A hand holding a notebook with writing

Description automatically generated

Close-up of a piece of paper with writing

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