

5. Develop a program to implement a sliding window protocol in the data link layer

```
import java.util.Random;
import java.util.Scanner;
public class program5 {
    private int[] frames; //stores all frame numbers (0,1,2,...).
    private int windowHeight;//how many frames can be sent at once.
    private int totalFrames; //total number of frames that need to be sent.
    // Constructor to initialize the number of frames and window size
    public program5(int totalFrames, int windowHeight) {
        this.totalFrames = totalFrames;
        this.windowHeight = windowHeight;
        this.frames = new int[totalFrames];
        // Initialize frames with frame numbers
        for (int i = 0; i < totalFrames; i++) {
            frames[i] = i;
        }
    }
    // Method to simulate the sliding window protocol
    public void sendFrames() {
        int currentFrame = 0; //keeps track of which frame we are currently sending from.
        Random random = new Random(); //used to simulate ACKs randomly.
        while (currentFrame < totalFrames) {
            // Send frames within the window
            for (int i = 0; i < windowHeight && (currentFrame + i) < totalFrames; i++) {
                System.out.println("Sent frame: " + frames[currentFrame + i]);
            }
            // Simulate receiving ACKs
            int maxAck = Math.min(windowHeight, totalFrames - currentFrame);
            int acksReceived = random.nextInt(maxAck) + 1; //random number between 1 and maxAck
            System.out.println("Received " + acksReceived + " ACKs.");
            currentFrame += acksReceived; // Slide the window
        }
        System.out.println("All frames have been sent and acknowledged.");
    }
}
```

```
public static void main(String[] args) {  
    Scanner scanner = new Scanner(System.in);  
    System.out.println("Enter the total number of frames: ");  
    int totalFrames = scanner.nextInt();  
    System.out.println("Enter the window size: ");  
    int windowHeight = scanner.nextInt();  
    program5 swp = new program5(totalFrames, windowHeight);  
    swp.sendFrames();  
    scanner.close();  
}  
}
```

Output :

1)Enter the total number of frames:

10

Enter the window size:

4

Sent frame: **0**

Sent frame: **1**

Sent frame: **2**

Sent frame: **3**

Received 3 ACKs.

Sent frame: **3**

Sent frame: **4**

Sent frame: **5**

Sent frame: **6**

Received 3 ACKs.

Sent frame: **6**

Sent frame: **7**

Sent frame: **8**

Sent frame: **9**

Received 4 ACKs.

All frames have been sent and acknowledged.

Output:

2)Enter the total number of frames:

11

Enter the window size:

4

Sent frame: 0

Sent frame: 1

Sent frame: 2

Sent frame: 3

Received 4 ACKs.

Sent frame: 4

Sent frame: 5

Sent frame: 6

Sent frame: 7

Received 2 ACKs.

Sent frame: 6

Sent frame: 7

Sent frame: 8

Sent frame: 9

Received 1 ACKs.

Sent frame: 7

Sent frame: 8

Sent frame: 9

Sent frame: 10

Received 4 ACKs.

All frames have been sent and acknowledged.