COMPUTER NETWORKS

LAB ASSESMENT-4

23BAI0037

R RITWIK REDDY

1.If the bandwidth of the line is 1.5 Mbps, RTT is 45 msec and packet size is 1 KB, then find the link utilization in stop and wait.

CODE:

```
bandwidth = 1.5 * 10**6  # bps
rtt = 45 / 1000        # sec
packet_size = 1 * 1024 * 8  # bits (1 KB)
T_frame = packet_size / bandwidth
utilization = T_frame / (T_frame + rtt)
print(f"Problem 1: Link Utilization = {utilization:.4f}")
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\1.py"
Problem 1: Link Utilization = 0.1082
```

2. A channel has a bit rate of 4 Kbps and one way propagation delay of 20 msec. The channel uses stop and wait protocol. The transmission time of the acknowledgement frame is negligible. To get a channel efficiency of at least 50%, what is the minimum frame size?

CODE:

```
bit_rate = 4 * 10**3
prop_delay = 20 / 1000
desired_efficiency = 0.5

min_frame_size_bits = (2 * bit_rate * prop_delay * desired_efficiency) / (1 - desired_efficiency)
```

```
min_frame_size_bytes = min_frame_size_bits / 8

print(f"Problem 2: Minimum Frame Size = {min_frame_size_bytes:.2f} bytes")
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\2.py"
Problem 2: Minimum Frame Size = 20.00 bytes
```

3. If the packet size is 1 KB and propagation time is 15 msec, the channel capacity is 109 b/sec, then find the transmission time and utilization of sender in stop and wait protocol.

CODE:

```
packet_size = 1 * 1024 * 8

prop_time = 15 / 1000

channel_capacity = 109


tx_time = packet_size / channel_capacity

utilization = tx_time / (tx_time + 2 * prop_time)


print(f"Problem 3: Transmission Time = {tx_time:.4f} sec")

print(f"Problem 3: Utilization = {utilization:.4f}")
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\3.py"
Problem 3: Transmission Time = 75.1560 sec
Problem 3: Utilization = 0.9996
```

4. Consider a MAN with average source and destination 20 Km apart and one way delay of 100 µsec. At what data rate does the round trip delay equals the transmission delay for a 1 KB packet?

CODE:

```
packet_size = 1 * 1024 * 8

one_way_delay = 100e-6


data_rate = packet_size / (2 * one_way_delay)


print("Problem 4: Required Data Rate =", data_rate, "bps")
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\4.py"
Problem 4: Required Data Rate = 40960000.0 bps
```

5. On a wireless link, the probability of packet error is 0.2. A stop and wait protocol is used to transfer data across the link. The channel condition is assumed to be independent from transmission to transmission. What is the average number of transmission attempts required to transfer 100 packets?

CODE:

```
p_error = 0.2

n_packets = 100

avg_transmissions = n_packets / (1 - p_error)

print("Problem 5: Average Number of Transmissions =", avg_transmissions)
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\5.py"
Problem 5: Average Number of Transmissions = 125.0
```

6. Compute the fraction of the bandwidth that is wasted on overhead (headers and retransmissions) for a protocol on a heavily loaded 50 Kbps satellite channel with data frames consisting of 40 bits header and 3960 data bits. Assume that the signal propagation time from the earth to the satellite is 270 msec. ACK frames never occur. NAK frames are 40 bits. The error rate for data frames is 1% and the error rate for NAK frames is negligible.

CODE:

```
channel_bw = 50 * 10**3

header_bits = 40

data_bits = 3960

frame_error_rate = 0.01

wasted_fraction = (header_bits + frame_error_rate * (header_bits + data_bits)) / (header_bits + data_bits)

print("Problem 6: Fraction of Bandwidth Wasted =", wasted_fraction)
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\6.py"
Problem 6: Fraction of Bandwidth Wasted = 0.02
```

7. A sender uses the stop and wait ARQ protocol for reliable transmission of frames. Frames are of size 1000 bytes and the transmission rate at the sender is 80 Kbps. Size of an acknowledgement is 100 bytes and the transmission rate at the receiver is 8 Kbps. The one way propagation delay is 100 msec. Assuming no frame is lost, what is the sender throughput in bytes/sec?

CODE:

```
frame_size_bytes = 1000

sender_rate = 80 * 10**3

ack_size_bytes = 100

receiver_rate = 8 * 10**3

prop_delay = 100 / 1000
```

```
tx_frame_time = (frame_size_bytes * 8) / sender_rate

tx_ack_time = (ack_size_bytes * 8) / receiver_rate

round_trip_time = 2 * prop_delay + tx_ack_time

throughput = frame_size_bytes / (tx_frame_time + round_trip_time)

print("Problem 7: Sender Throughput =", throughput, "bytes/sec")
```

```
[Running] python -u "c:\PROGRAMMING\C\COMPUTER NETWORKS\LAB DA4\tempCodeRunnerFile.py"
Problem 7: Sender Throughput = 2500.0 bytes/sec
```