Lab 1

Part 1 - Wired Environment

```
[zhaoz@royal-30] (72)$ java Iperfer.java -s -p 8169
received=585091 KB rate=932.602 Mbps
```

```
[zhaoz@royal-07] (3)$ java Iperfer.java -c -h royal-30 -p 8169 -t 5
sent=585091 KB rate=935.024 Mbps
```

Part 1 - Wireless Environment

```
andyf@macprozfu Iperfer % java Iperfer -s -p 50000
received=15619 KB rate=24.197 Mbps
andyf@macprozfu Iperfer % java Iperfer -s -p 50000
received=14009 KB rate=34.346 Mbps
andyf@macprozfu Iperfer % java Iperfer -s -p 50000
received=51182 KB rate=20.180 Mbps
```

```
E:\2022Fall\640\Iperfer>java Iperfer -c -h macprozfu.lan -p 50000 -t 5
sent=15619 KB rate=24.965 Mbps

E:\2022Fall\640\Iperfer>java Iperfer -c -h macprozfu.lan -p 50000 -t 3
sent=14009 KB rate=36.878 Mbps

E:\2022Fall\640\Iperfer>java Iperfer -c -h macprozfu.lan -p 50000 -t 20
sent=51182 KB rate=20.463 Mbps

E:\2022Fall\640\Iperfer>
```

Part 1 - Iperfer Results

Prediction: The throughput in the wireless environment will be less than that in the wired environment.

Explanation: The results match our expectation because we believe that in the wireless environment, routing is more complex, and all 4 types of latency will increase as a result.

Part 3 - Q2 Predictions

The average RTT will be 140ms. The throughput will be 20 Mbps.

Part 3 - Q2 Results

The **ACTUAL** average RTT is 143.467ms. The **ACTUAL** throughput is 21.145Mbps.

Explanation: We think that our predictions are correct because the discrepancy is controlled within an acceptable range. The average RTT is two times the sum of the latency of each link through which data transfer, i.e., $2 \times (L_{\mathrm{L1}} + L_{\mathrm{L2}} + L_{\mathrm{L3}})$. The throughput is the minimum bandwidth of all links through which data transfer, i.e., $Min(BW_{\mathrm{L1}}, BW_{\mathrm{L2}}, BW_{\mathrm{L3}})$.

Part 3 - Q3 Predictions

Two Pairs

The average RTT will be 140ms. The throughput will be 10Mbps for each pair.

Three Pairs

The average RTT will be 140ms. The throughput will be 6.67Mpbs for each pairs.

Part 3 - Q3 Results

Two Pairs

The **ACTUAL** average RTT between h1 and h4 is 144.148ms. The **ACTUAL** throughput between h1 and h4 is 12.987Mbps.

The **ACTUAL** average RTT between h7 and h9 is 143.327ms. The **ACTUAL** throughput between h7 and h9 is 9.236Mbps.

Explanation: Our prediction for the average RTT is correct, while there exists some discrepancy with our prediction for the throughput. We believe that it's because we couldn't really start measuring the bandwidths of both paths exactly at the same time, and the one started earlier would have a higher bandwidth as a result of the calculation method. However, the sum of the bandwidths is still within ~20Mbps, which is expected.

Three Pairs

The **ACTUAL** average RTT between h1 and h4 is 143.142ms. The **ACTUAL** throughput between h1 and h4 is 11.914Mbps.

The **ACTUAL** average RTT between h7 and h9 is 143.989ms. The **ACTUAL** throughput between h7 and h9 is 7.537Mbps.

The **ACTUAL** average RTT between h8 and h10 is 143.896ms. The **ACTUAL** throughput between h7 and h9 is 3.628Mbps.

Explanation: Our prediction for the average RTT is correct, while there exists some discrepancy with our prediction for the throughput. The reasons for the discrepancies are the same as what we said above. The sum of the bandwidths is still within ~20Mbps, which is expected.

Part 4 - Q4 Predictions

The average RTT from h1 to h4 will be 140ms. The throughput will be 20Mpbs.

The average RTT from h5 to h6 will be 80ms. The throughput will be 30Mpbs.

Part 4 - Q4 Results

The **ACTUAL** average RTT from h1 to h4 is 144.038ms. The **ACTUAL** throughput is 17.343 Mbps.
The **ACTUAL** average RTT from h5 to h6 is 84.023ms. The **ACTUAL** throughput is 28.624 Mbps.

Explanation: From h1 to h4, there are three links involved: L1, L2 and L3, so the estimated round-trip time should be around (40 + 10 + 20) * 2 = 140ms, while the throughput should be around the smallest of the three links' bandwidth, which is 20 Mbps. Our results match the estimation.
From h5 to h6, there are three links involved: L4, L2 and L5, so the estimated round-trip time should be around (15 + 10 + 15) * 2 = 80ms, while the throughput should be around the smallest of the three links' bandwidth, which is 30 Mbps. Our results match the estimation.