CS549 Lab Assignment -2

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Experiment

Description: In this experiment, we aim to measure network throughput using the **wget** utility under different conditions. Network throughput is a crucial metric that reflects the amount of data transferred successfully over a network connection within a given time frame. By controlling factors such as **file size, download speed limit, number of concurrent downloads, and time of day**, we assess how these variables influence network performance.

File Size: 1B, 1KB, 10KB, 100KB, 500KB, 1MB, 10MB, 100MB, 500MB
Concurrent Downloads: 1, 3, 5
Download Speed Limit: 1 MBps , 2 MBps, 4MBps
Time of Day: Morning, Evening, Night

Rank Method

The ranking method is a decision-making technique where items are ordered or prioritized based on their relative positions or attributes, without assigning specific numerical values. It involves comparing items against each other according to predefined criteria and assigning ranks accordingly, allowing for straightforward comparisons and prioritization without the need for precise numerical measurements.

Factor	-1	1
File size	1B	500MB
Speed limit	1 MBps	4 MBps
Concurrent downloads	1	5
Time of Day	Morning	Night

By Considering Extreme cases for each of the factors and performing 12 experiments, we get the below outputs:

File size	Speed limit	Concurrent downloads	Time of Day	Throughput (MB/s)
-1	-1	-1	1	0.000002
-1	-1	-1	-1	0.000002
-1	1	1	1	0.000003
-1	-1	1	-1	0.000006
-1	-1	1	1	0.000009
-1	1	-1	-1	0.000012
1	-1	-1	-1	0.249785
1	-1	-1	1	0.975533
1	1	1	1	1.101434
1	1	1	-1	1.909940
1	1	-1	1	3.623101
1	1	-1	-1	3.798298

Conclusion:

We sort the data points and set the threshold for throughput to be 0.5 MBps and since more throughput is desired, we consider only the 5 rows.

From the table it can be observed that File size and Speed limit are the most important factors which we will consider for further analysis.

Range Method

The range method is a statistical approach employed to assess the dispersion or variability within a dataset by quantifying the difference between its highest and lowest values. This method offers a simple yet insightful measure of the spread present in the data, aiding in the understanding of the extent to which values diverge from one another across the observed range.

Factor 1: File size [speed limit: 1 MBps, concurrent downloads: 1, time of day: Morning]

File size (Bytes)	Throughput (MB/s)
1	0.000004
1000	0.005940
10000	0.017607
100000	0.230844
500000	0.293039
1000000	0.850418
10000000	0.905124
100000000	0.965693
500000000	0.943211

Factor 2: Speed limit [file size: 10 MB, concurrent downloads: 1, time of day: Morning]

Speed limit (MB/s)	Throughput (MB/s)
1	0.905124
2	1.888786
4	2.497209

Factor 3: Concurrent downloads [speed-limit: 1 MBps, file-size: 10 MB, time of day: Morning]

Concurrent Downloads	Throughput (MB/s)
1	0.905124
3	0.966697
5	1.038439

Factor 4:Time of day [speed-limit: 1 MBps, concurrent downloads: 1, file size: 10 MB]

Time of Day	Throughput (MB/s)
Evening	0.563327
Morning	0.964634
Night	0.905124

By Range Method, we were able to obtain the following ranges for each of the factors:

1. **File Size:** [0.000004, 0.943211]
2. **Speed Limit**: [0.905124, 2.497209]
3. **Concurrent Downloads**: [0.905124, 1.038439]
4. **Time of Day**: [0.563327, 0.905124]

Variance for factor File Size and Speed Limit is highest from which we can conclude that these two factors are most important.

Analysis of Variance

Analysis for File Size:

SSA (Between-Group Sum of Squares): 3.4375941546524023
SSE (Within-Group Sum of Squares): 0.27619697423664036
SST (Total Sum of Squares): 3.7137911288890426
MSA (Mean Square for Between-Group): 0.4296992693315503
MSE (Mean Square for Within-Group): 0.01534427634648002
F-value: 28.003879728751325
F-critical: 2.5101578953835753

Analysis for Speed Limit:

SSA (Between-Group Sum of Squares): 5.008169364689236
SSE (Within-Group Sum of Squares): 1.9070733124262393
SST (Total Sum of Squares): 43.14963561321402
MSA (Mean Square for Between-Group): 2.504084682344618
MSE (Mean Square for Within-Group): 0.31784555207103987
F-value: 7.878306510908619
F-critical: 5.143252849784718

Since F-value is greater than F-critical thus, this factor is significant to our experiment