Simulation Results Graphs and Cluster Analyses for: "The Influence of Realism on Congestion in Network Simulations"

NIST Technical Note

C. Dabrowski & K. Mills

2015

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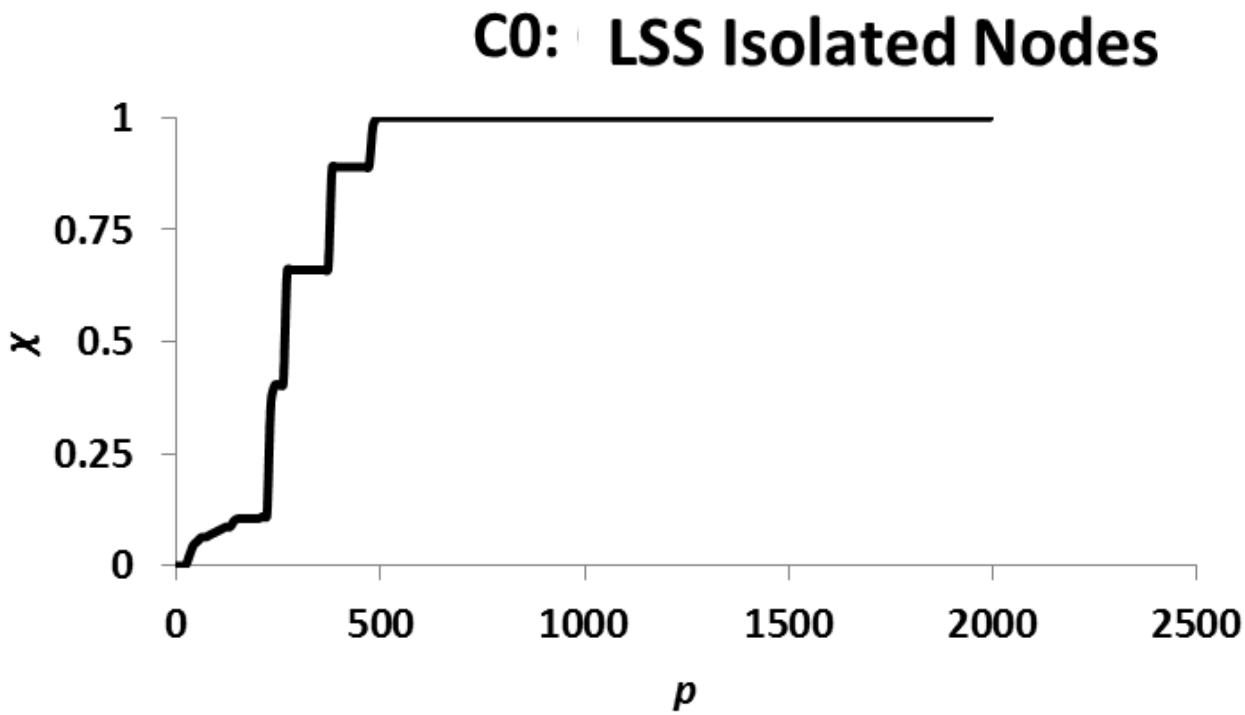
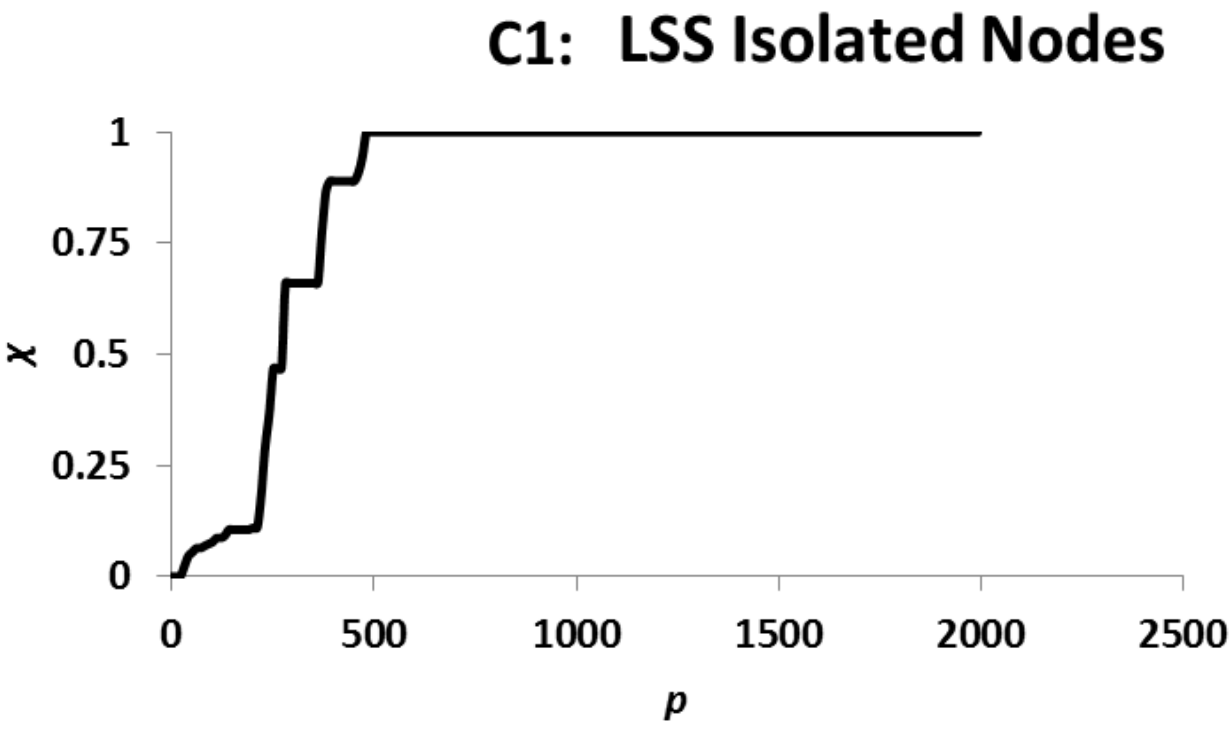
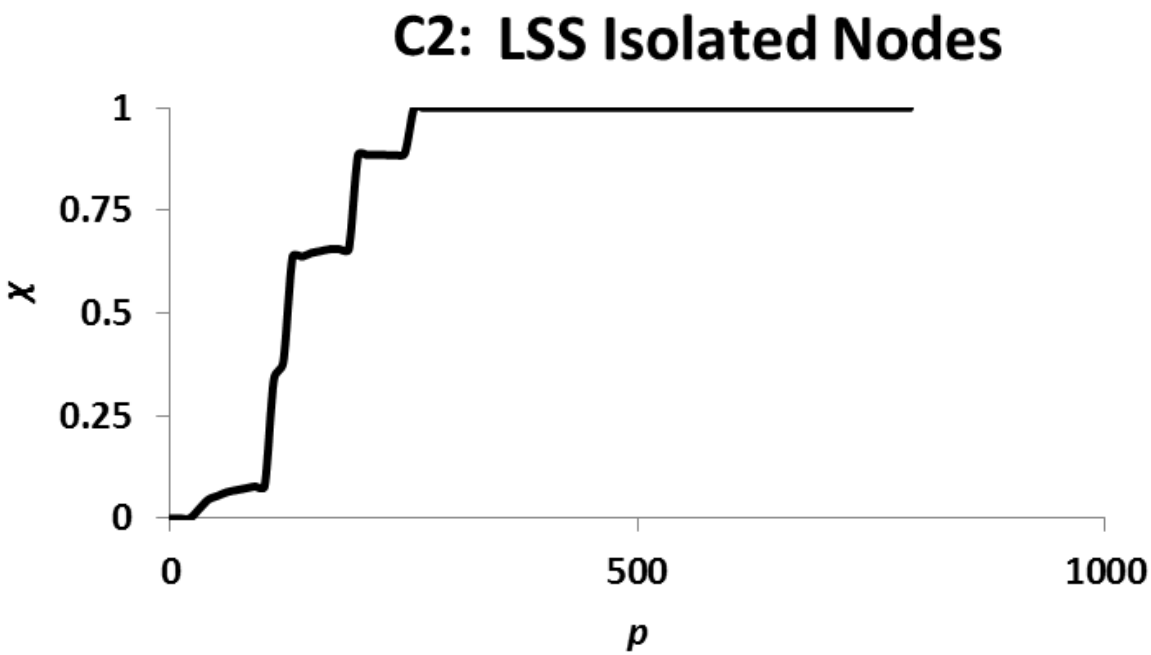
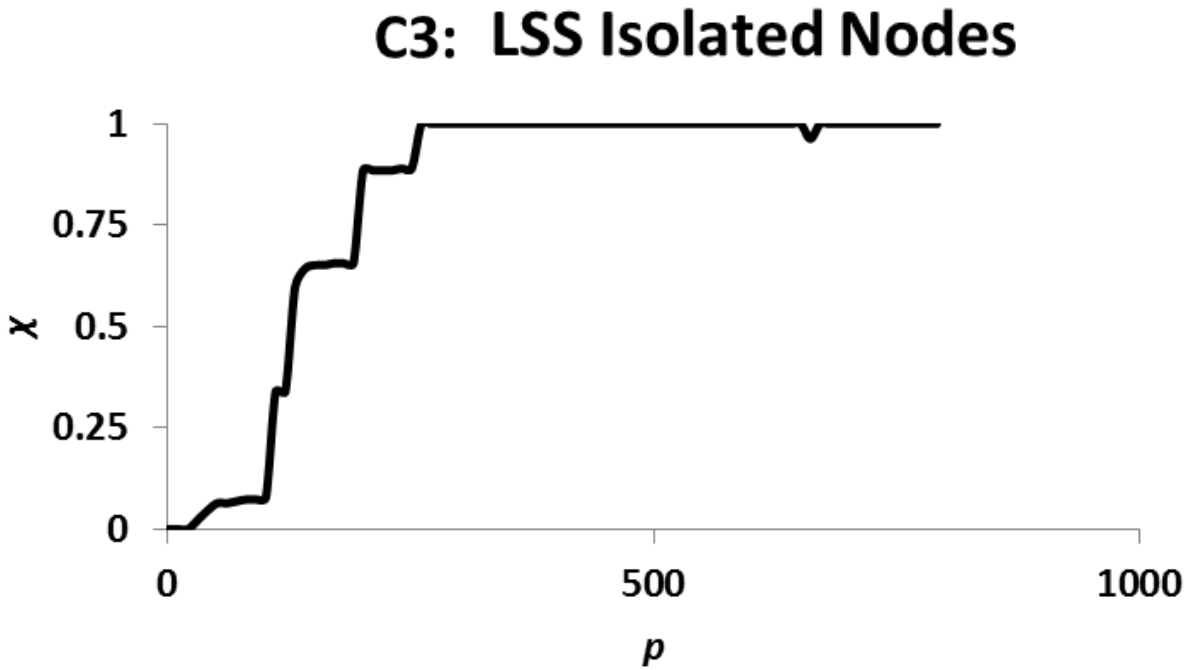
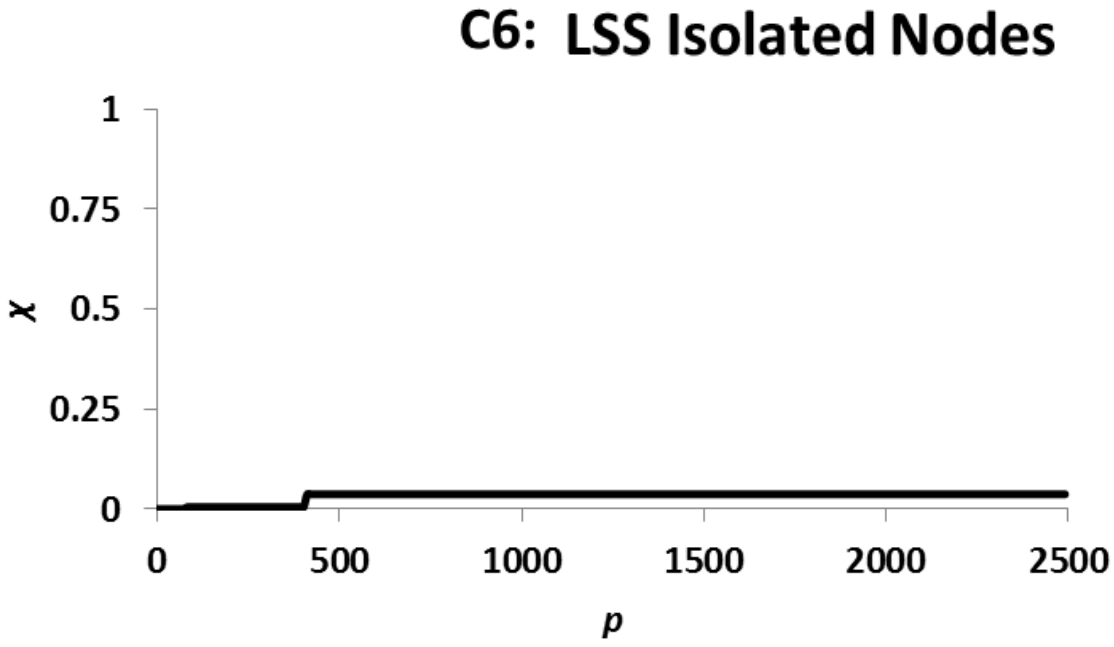
Graphs for Isolated Nodes (χ) Figure 21
(Dabrowski & Mills NIST)

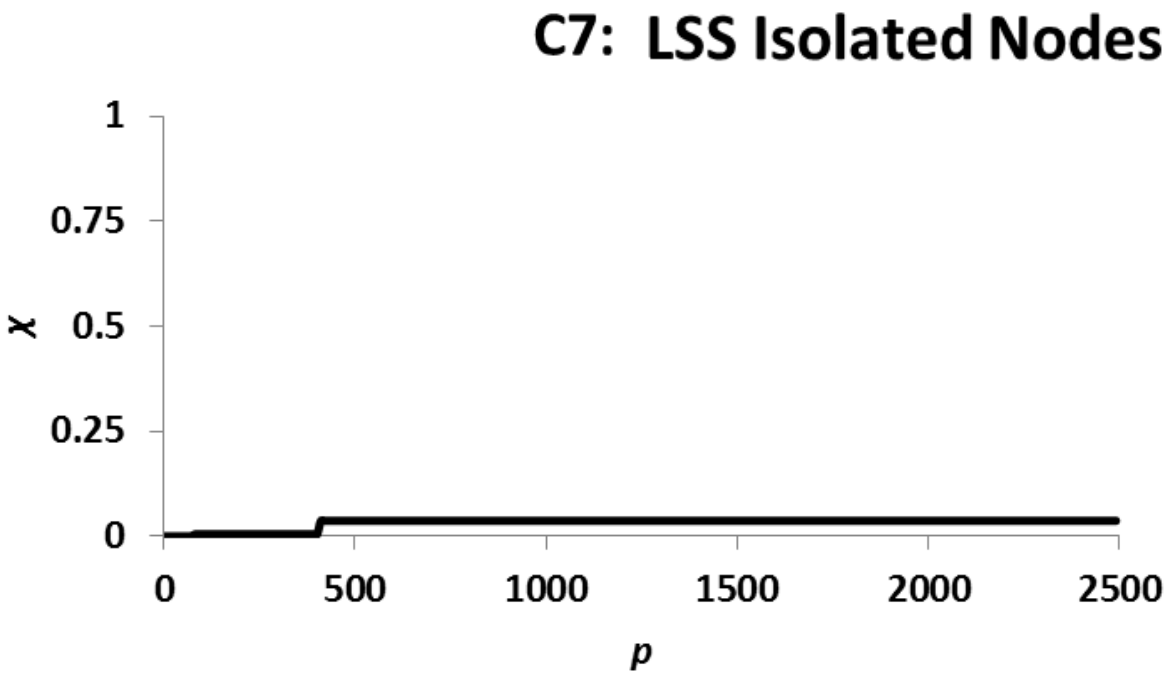

C0: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

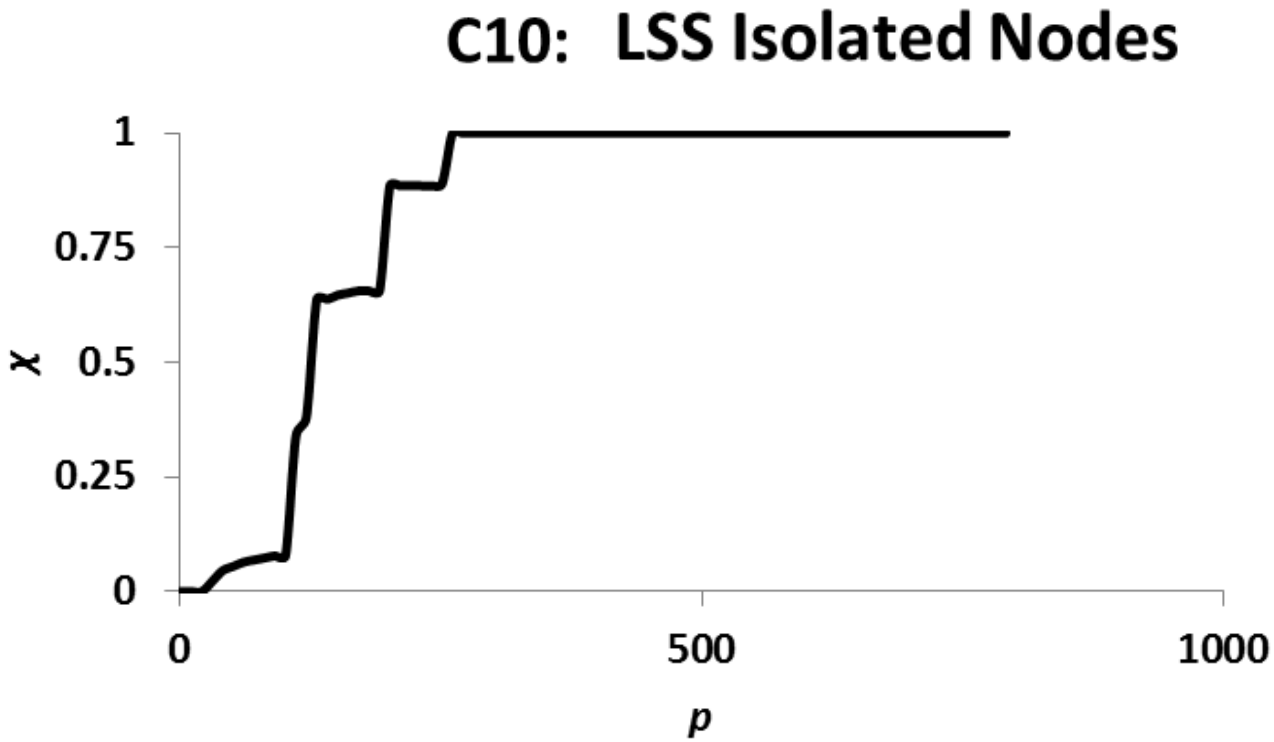

C1: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

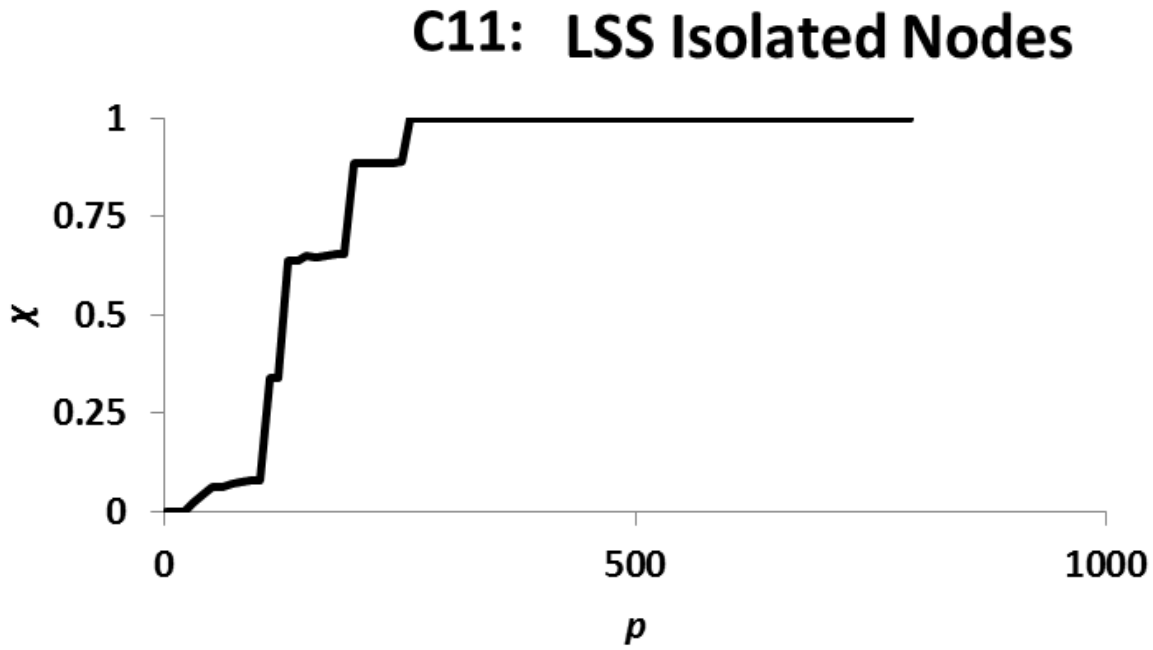

C2: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

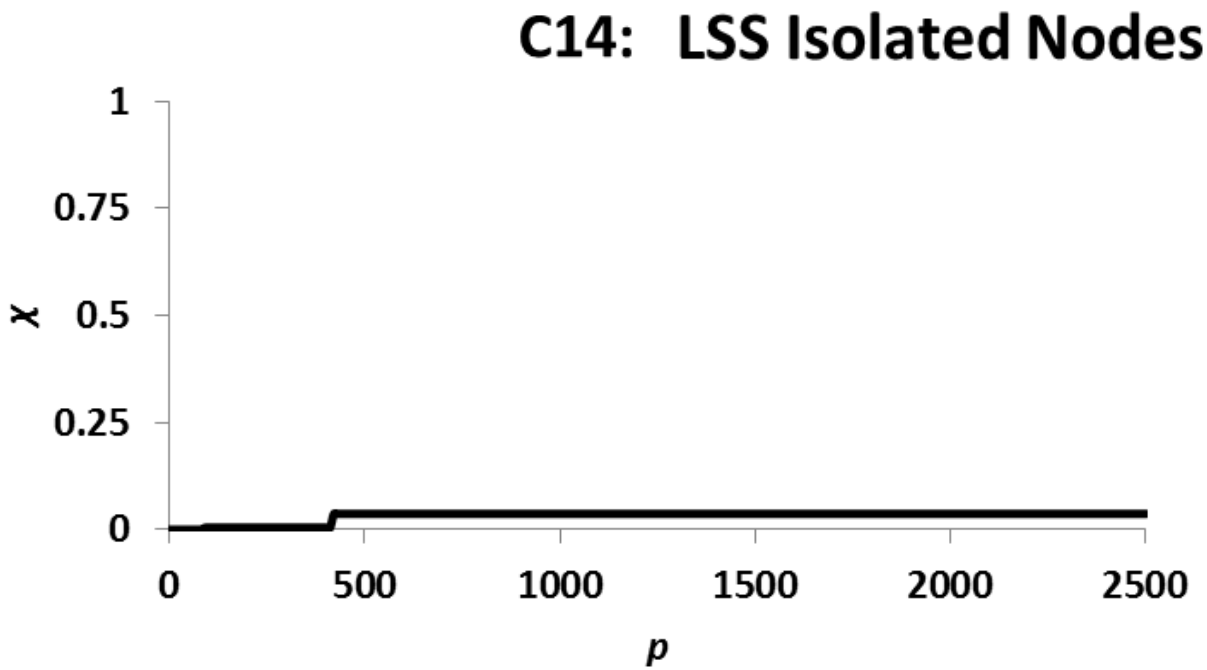

C3: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

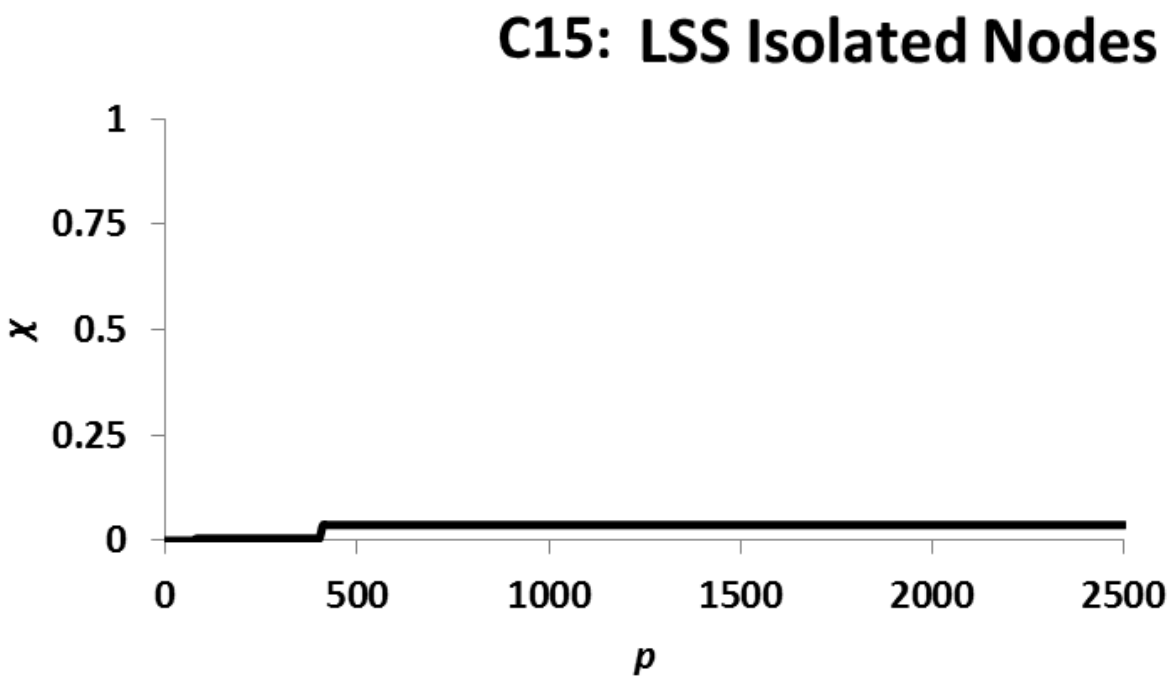

C6: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

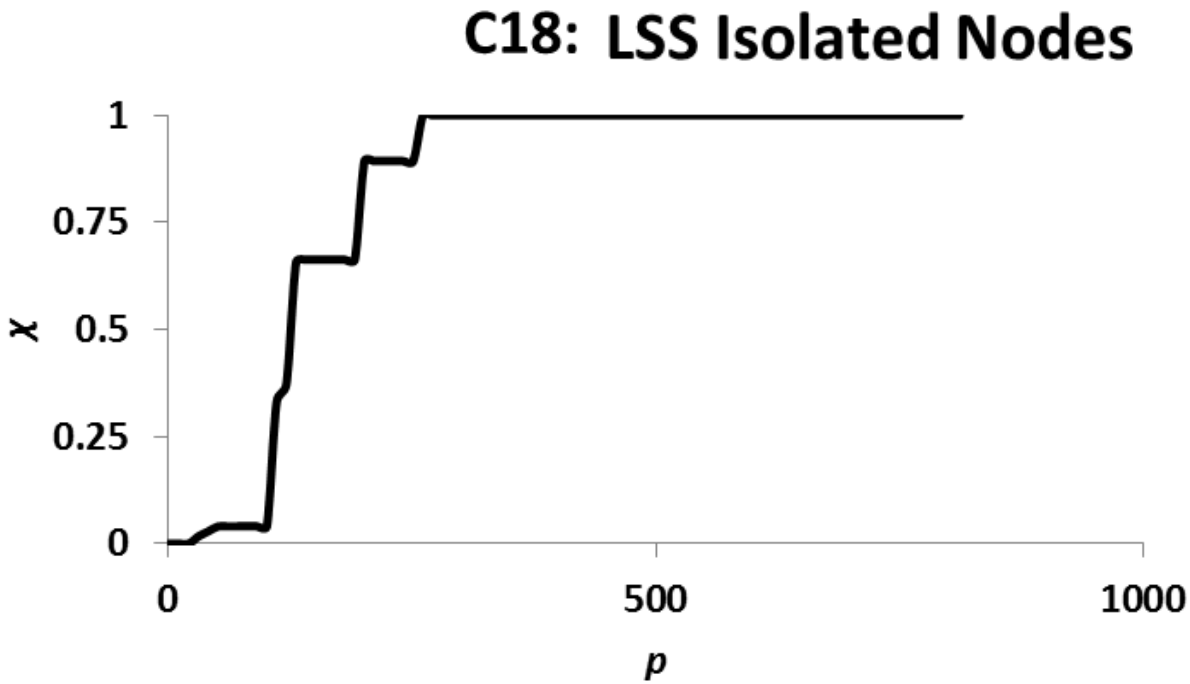

C7: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

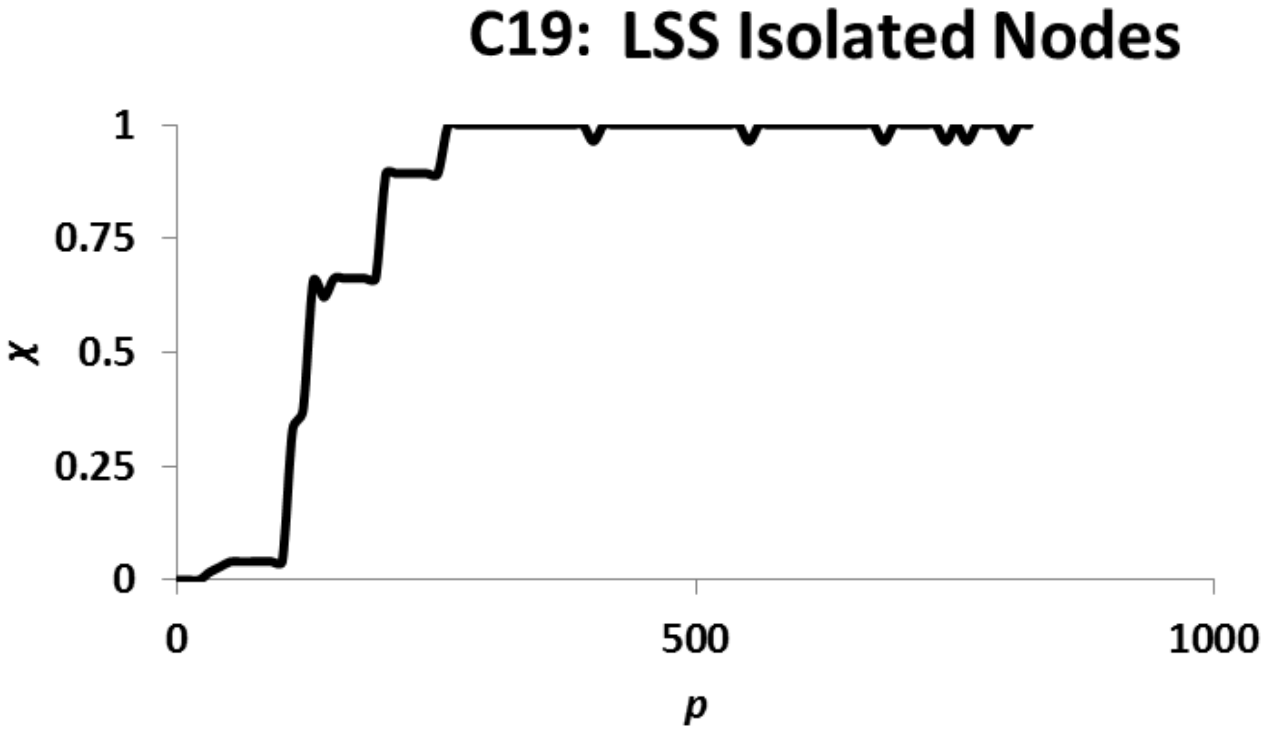

C10: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

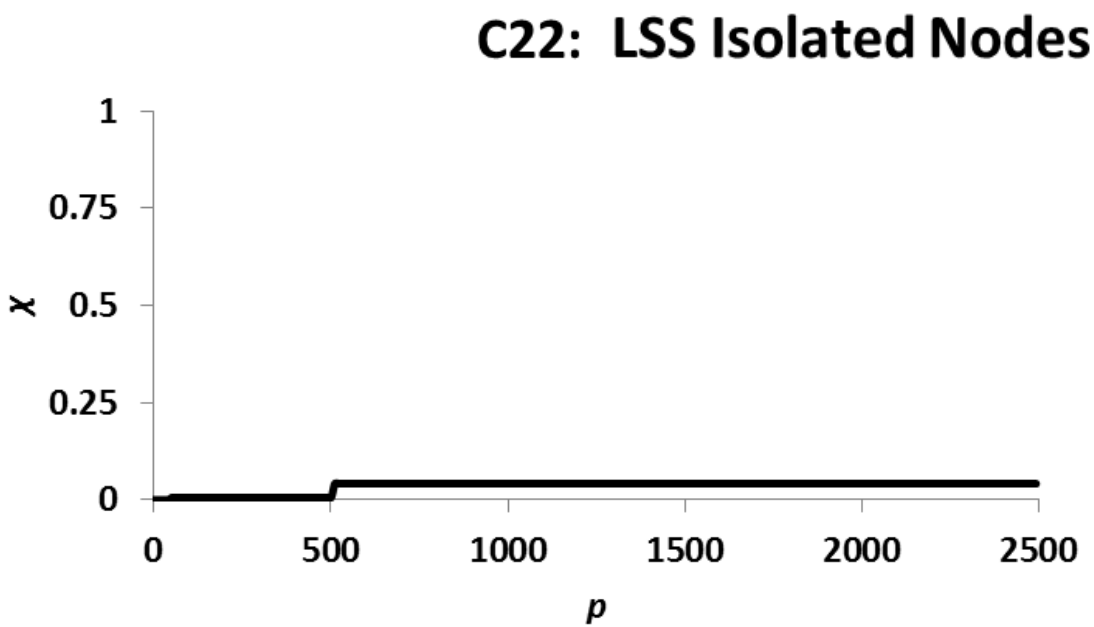

C11: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

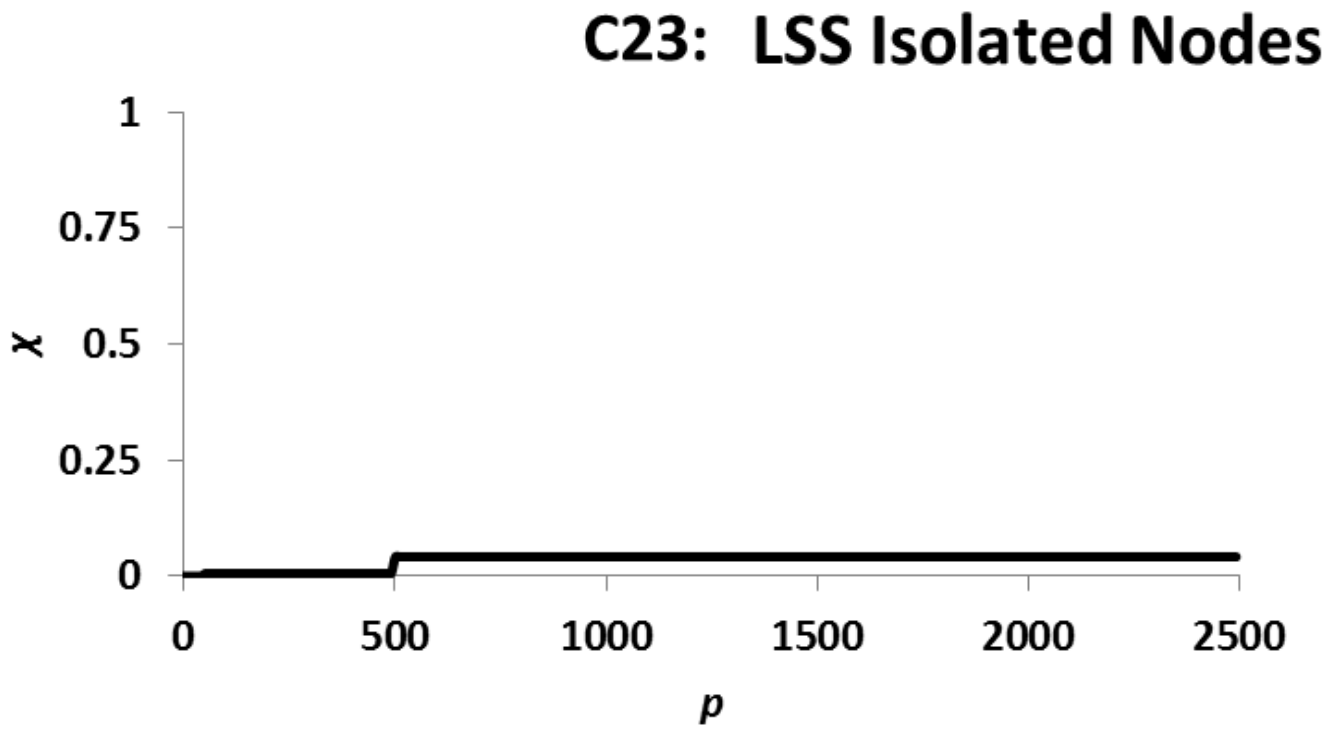

C14: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

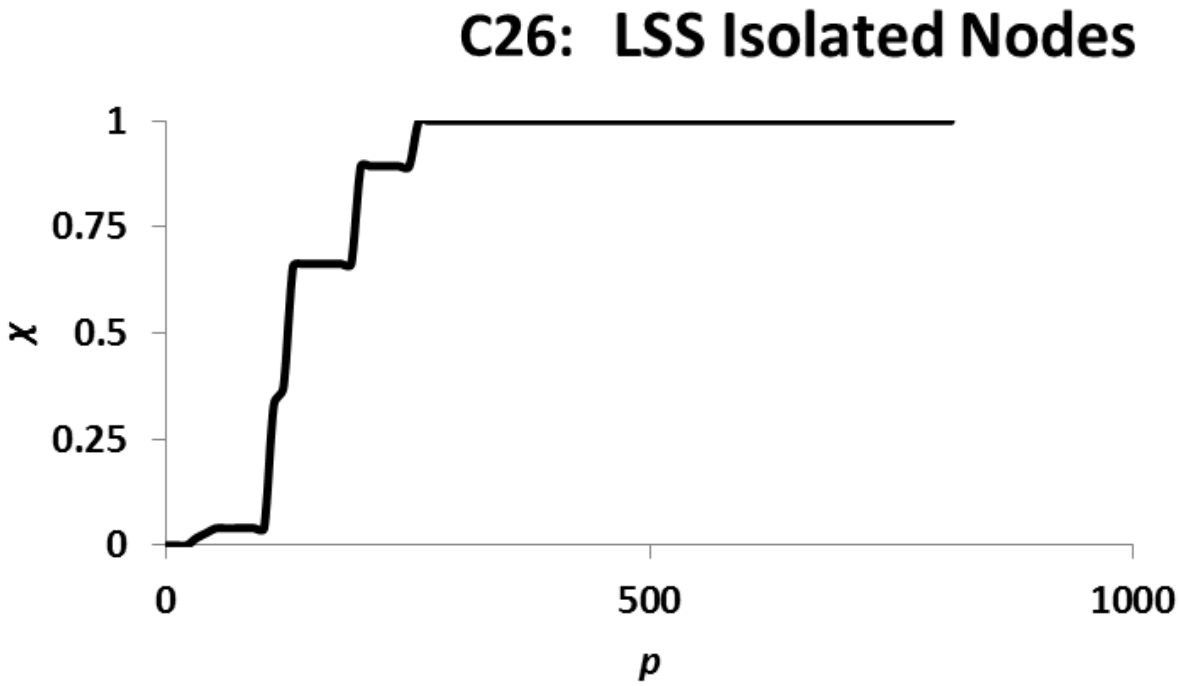

C15: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

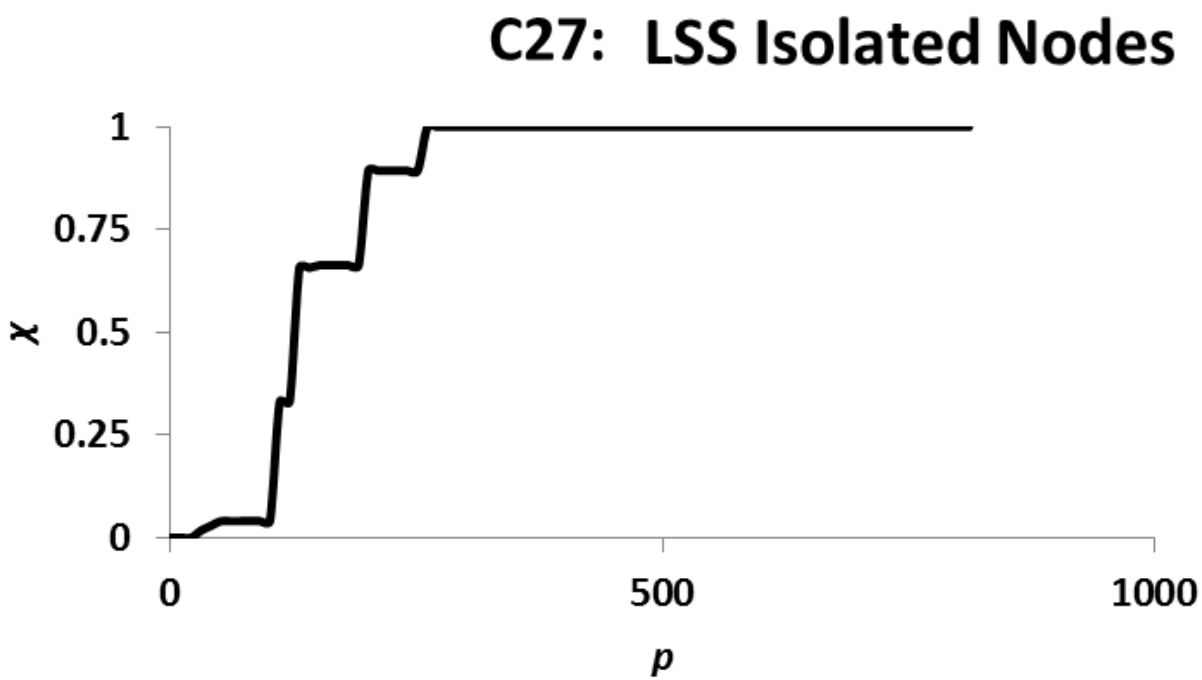

C18: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

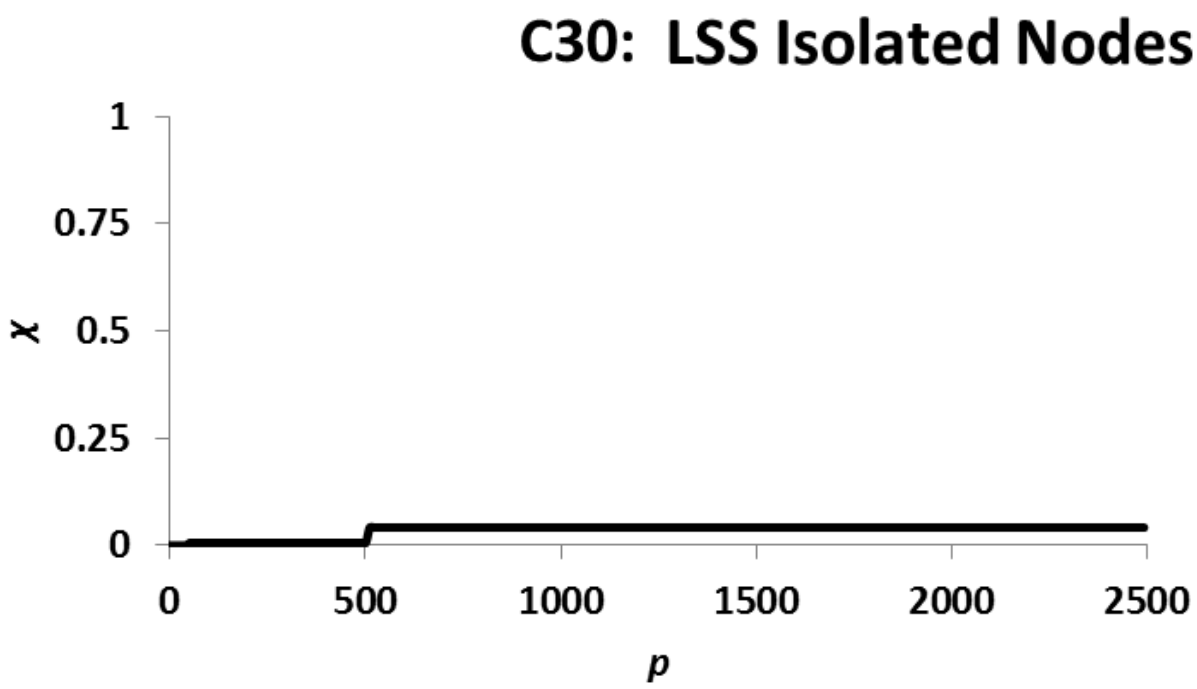

C19: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

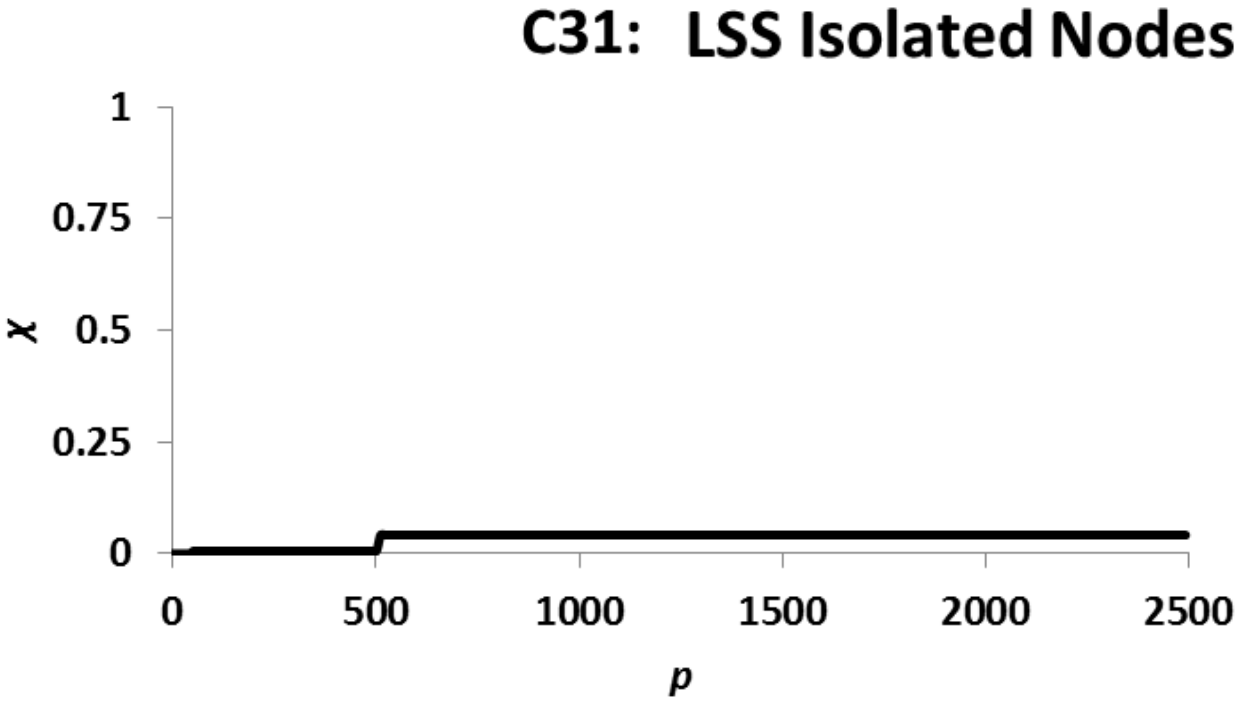

C22: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

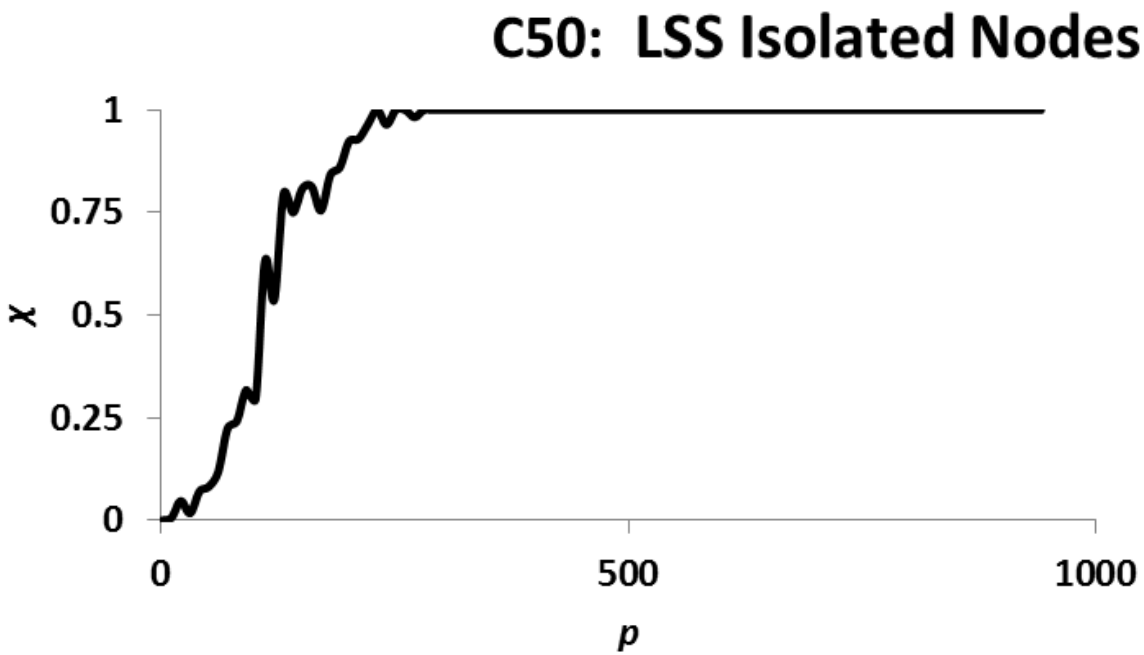

C23: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

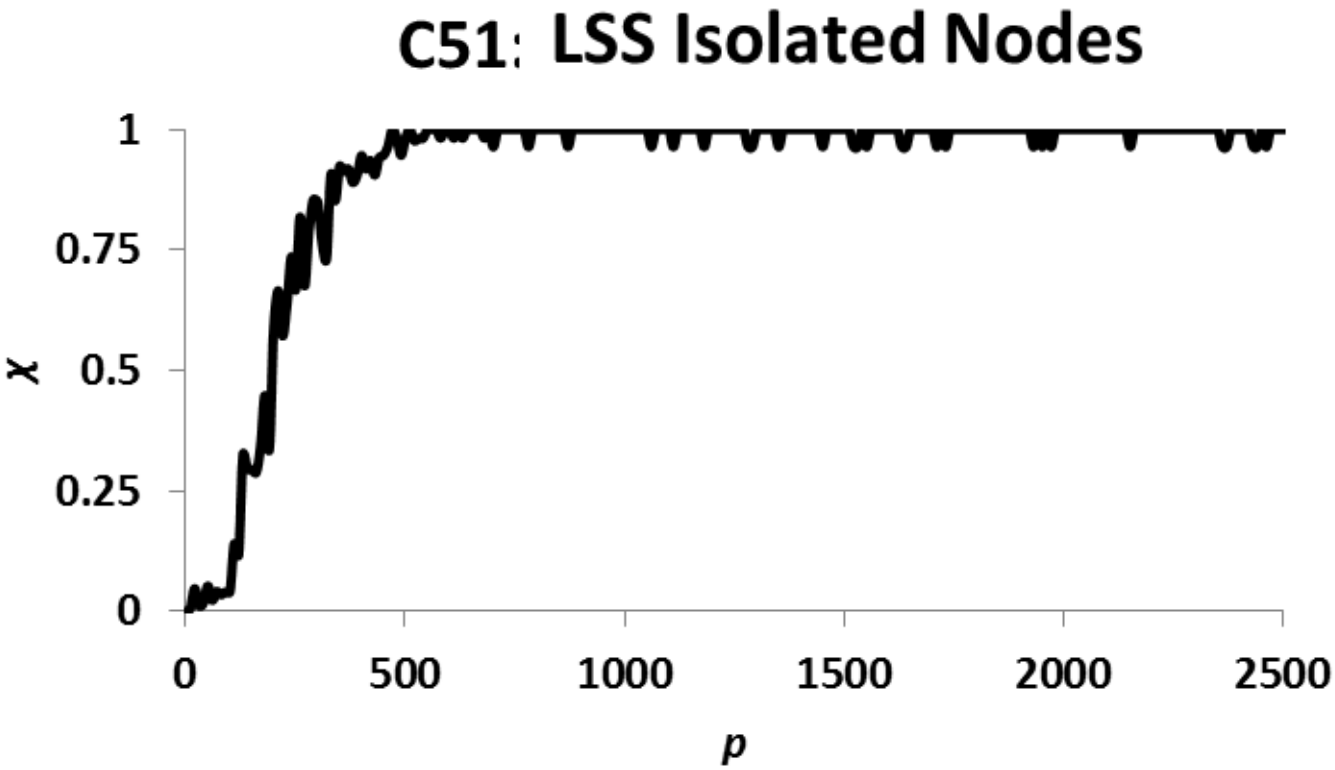

C26: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

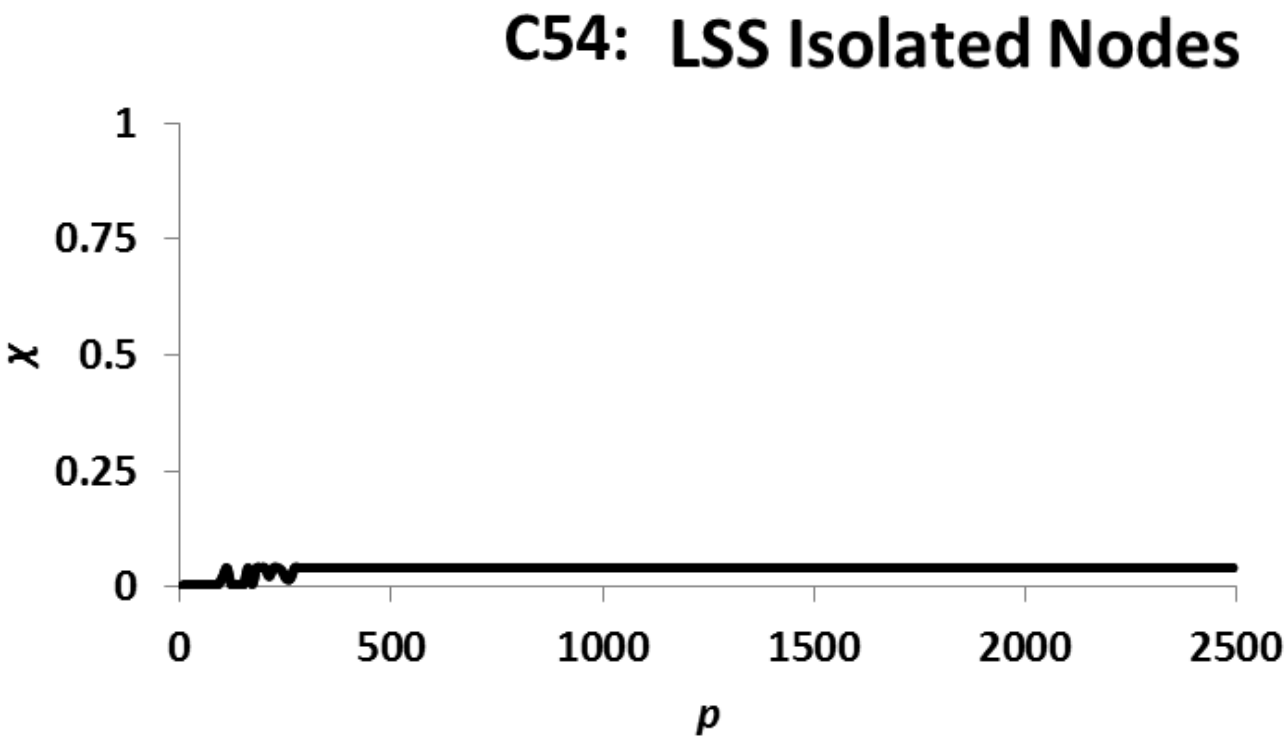

C27: LSS Isolated Nodes
1
0.75
0.5
0.25
0
ϰ
0
500
1000
p

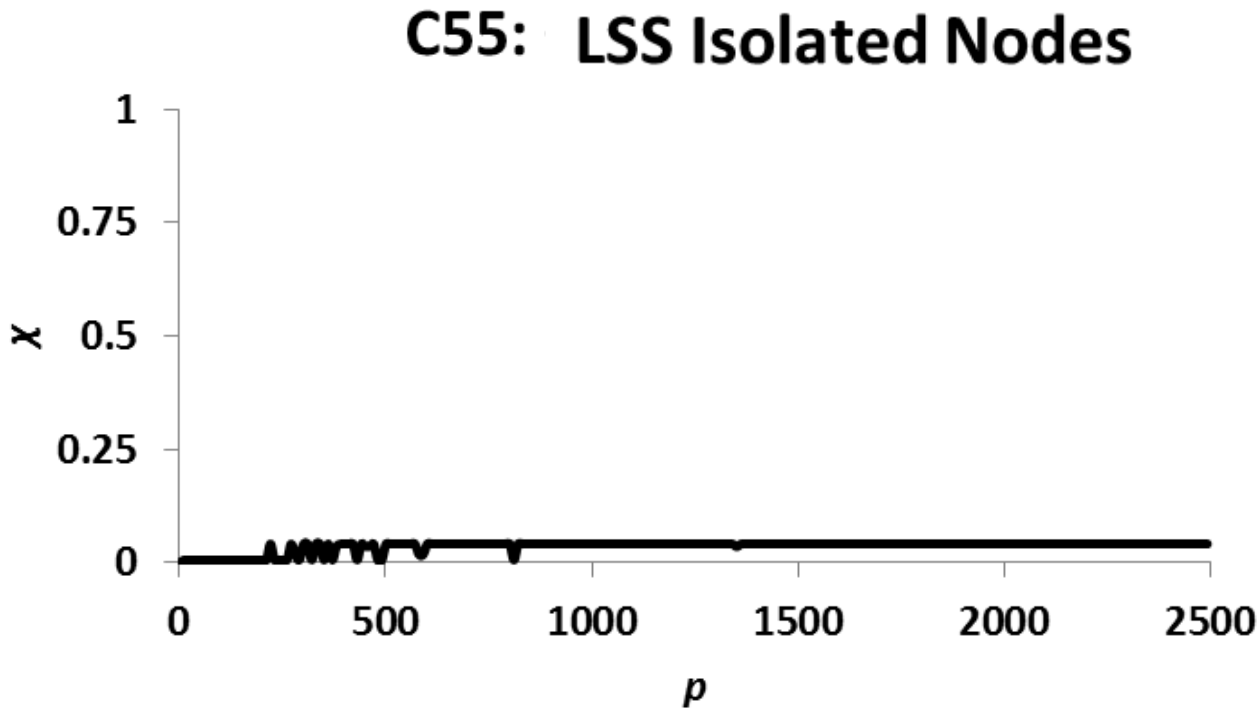

C30: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

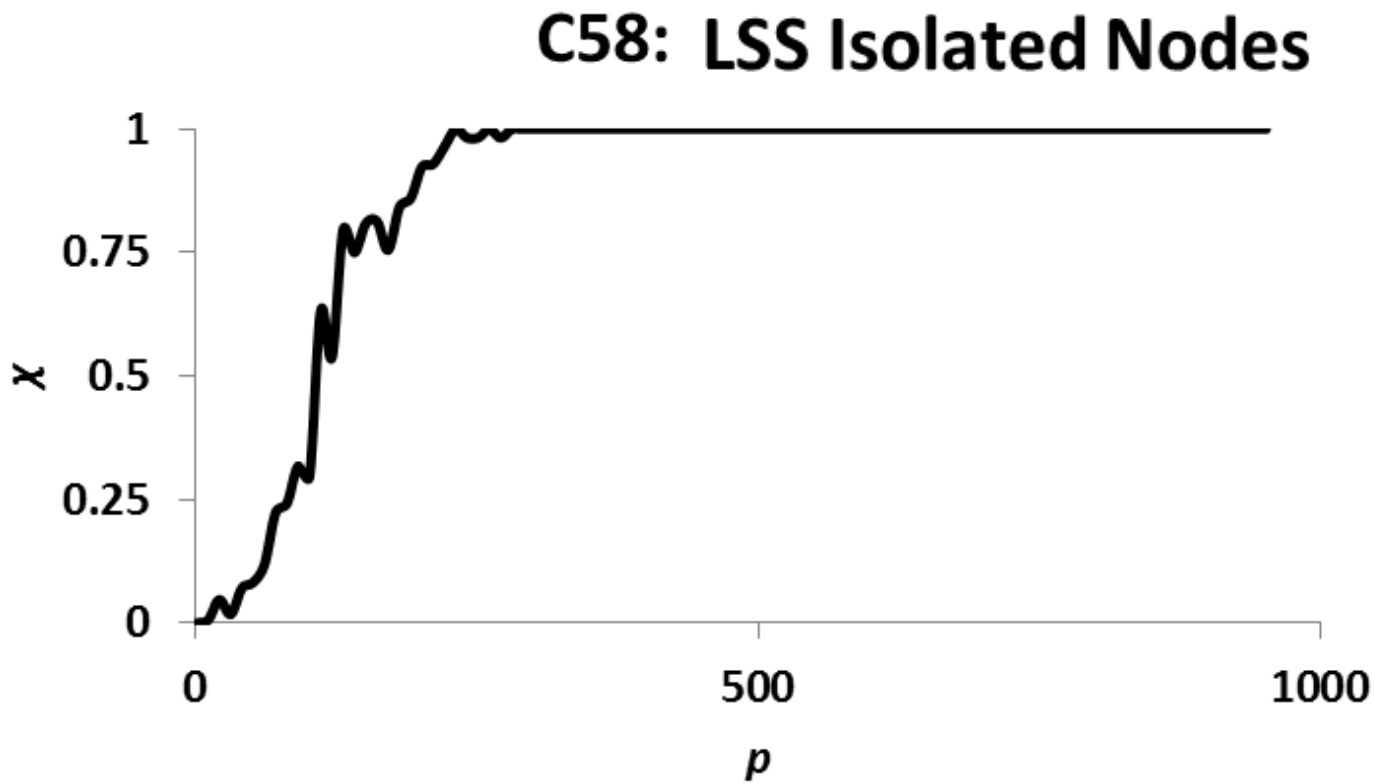

C31: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

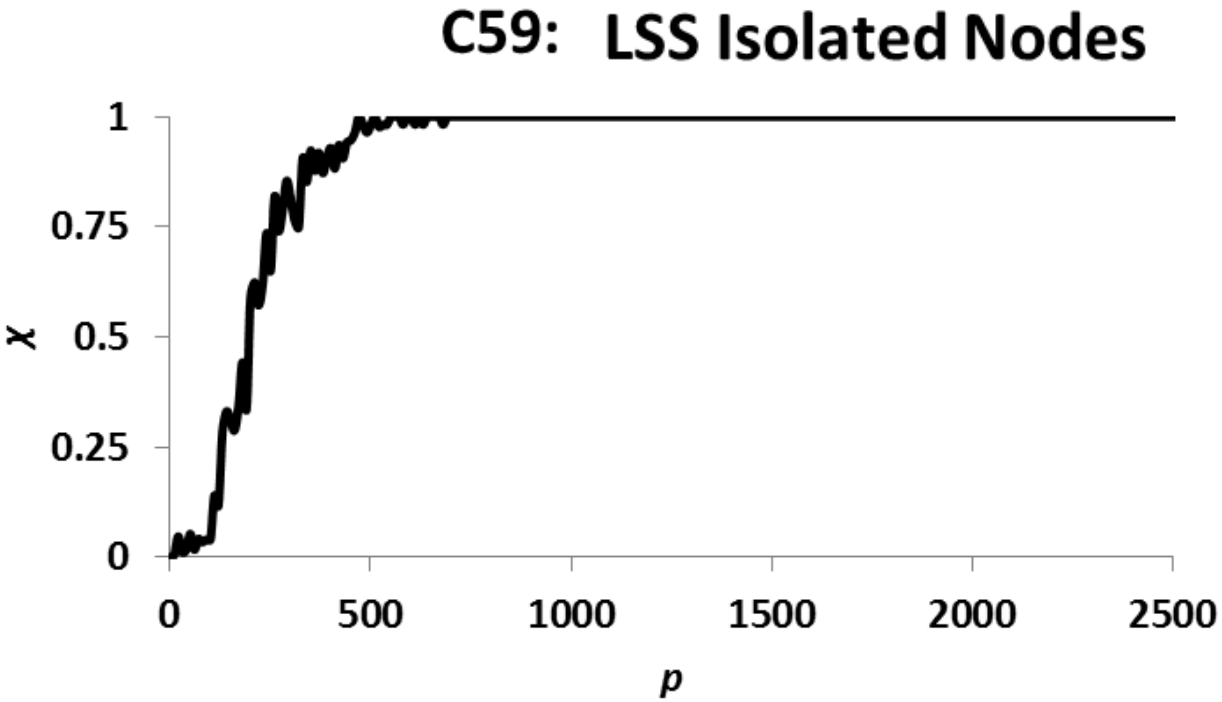

C50: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

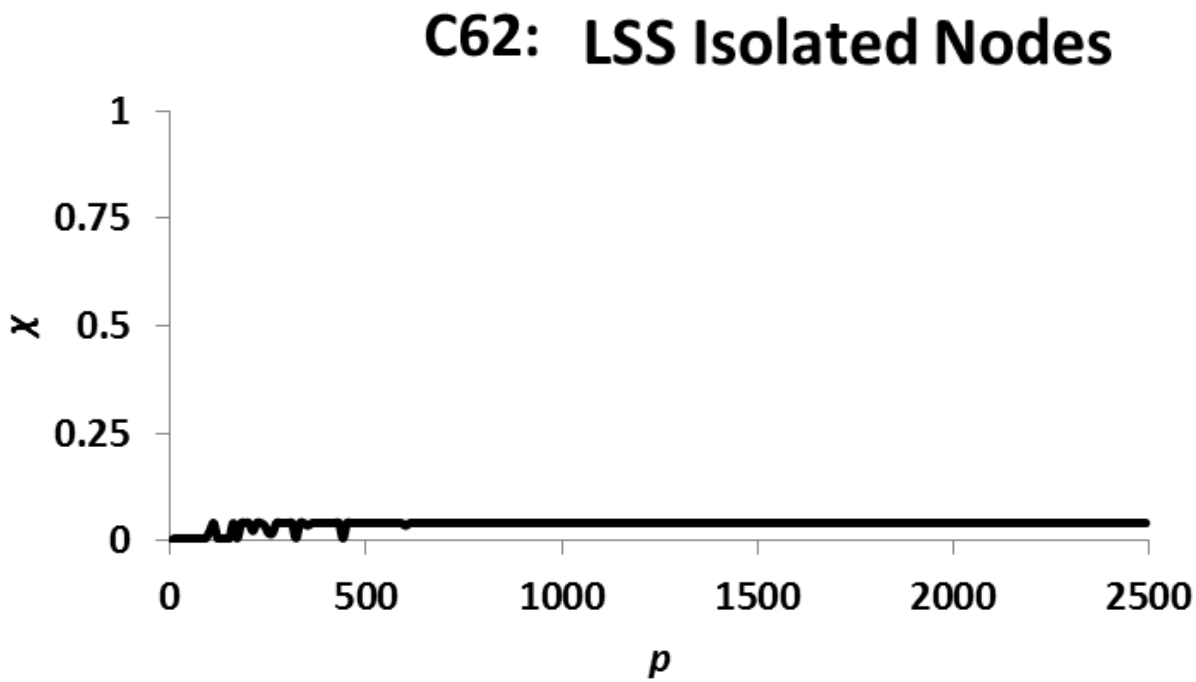

C51: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p


C54: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

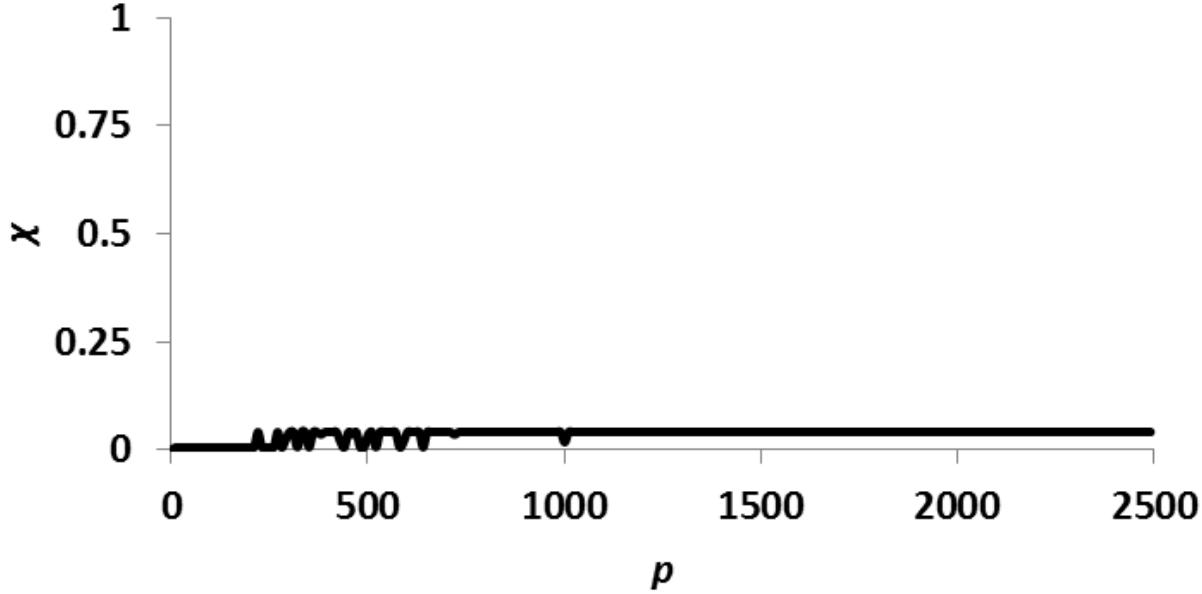

C55: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

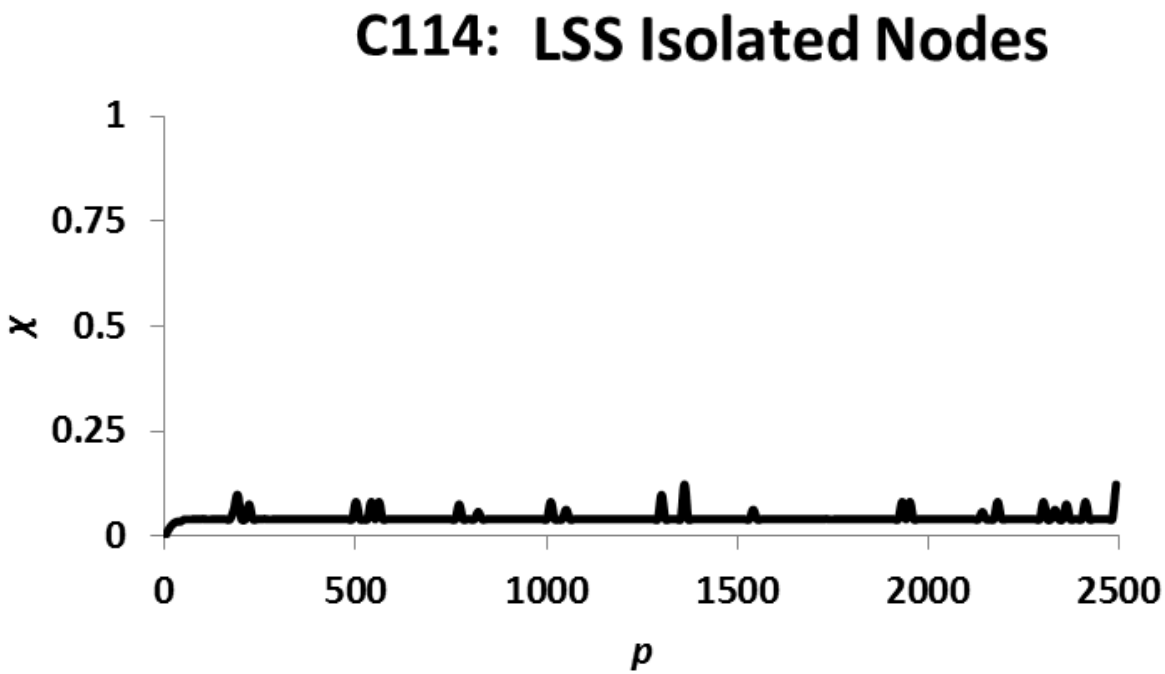

C58: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
p

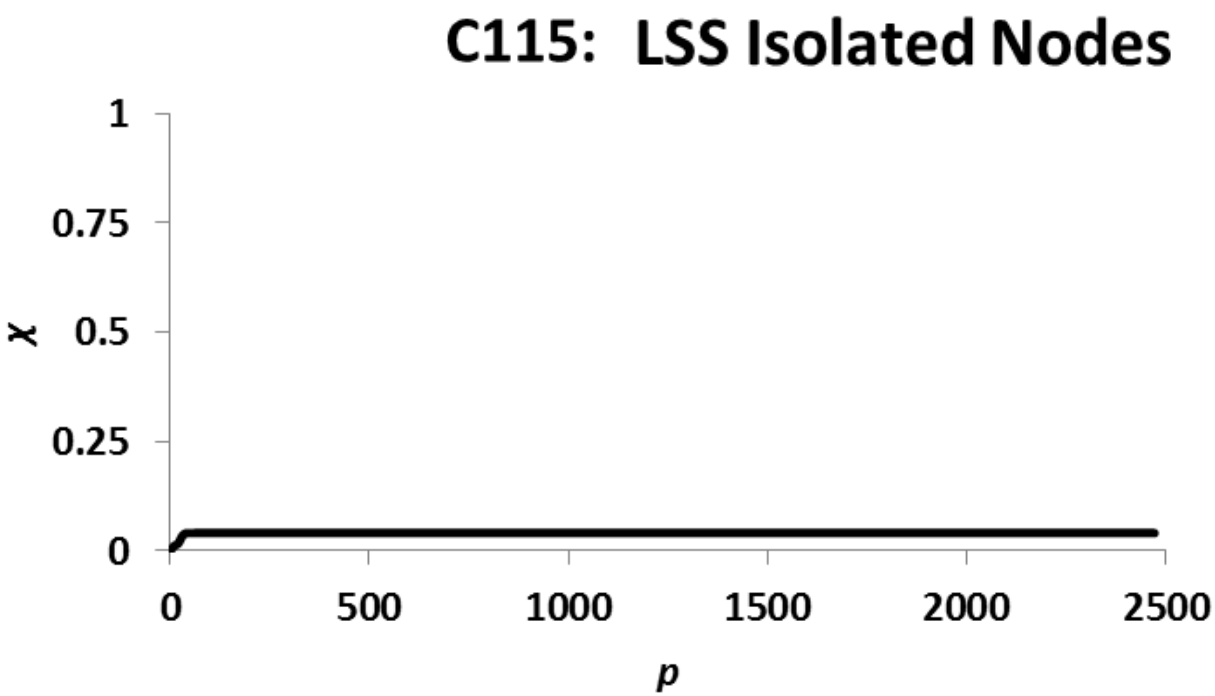

C59: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

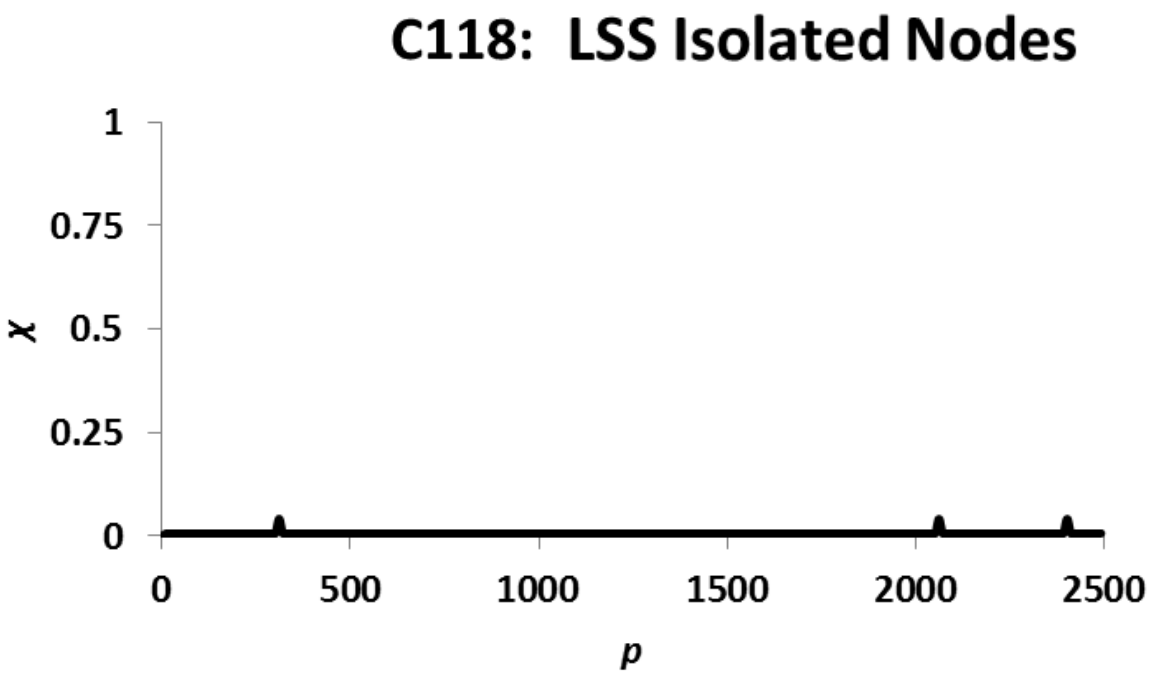

C62: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

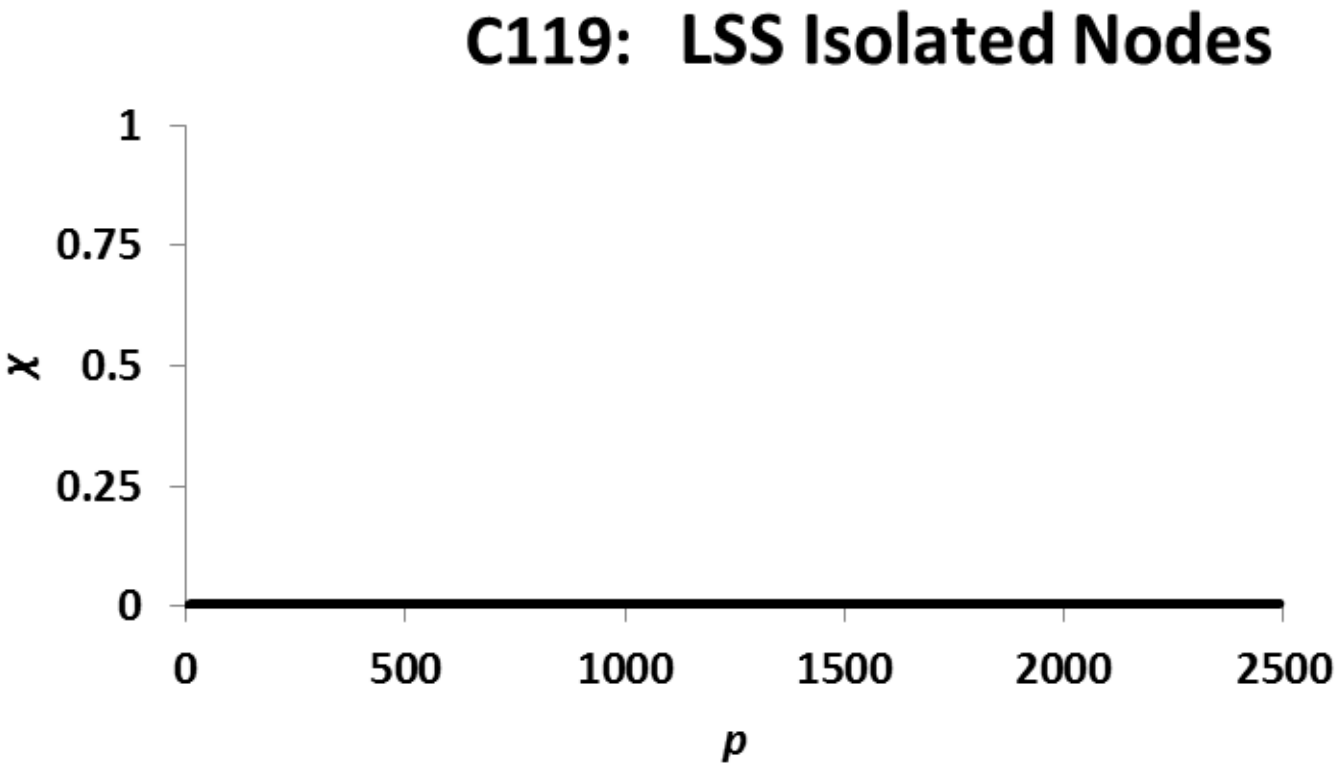
C63: LSS Isolated Nodes

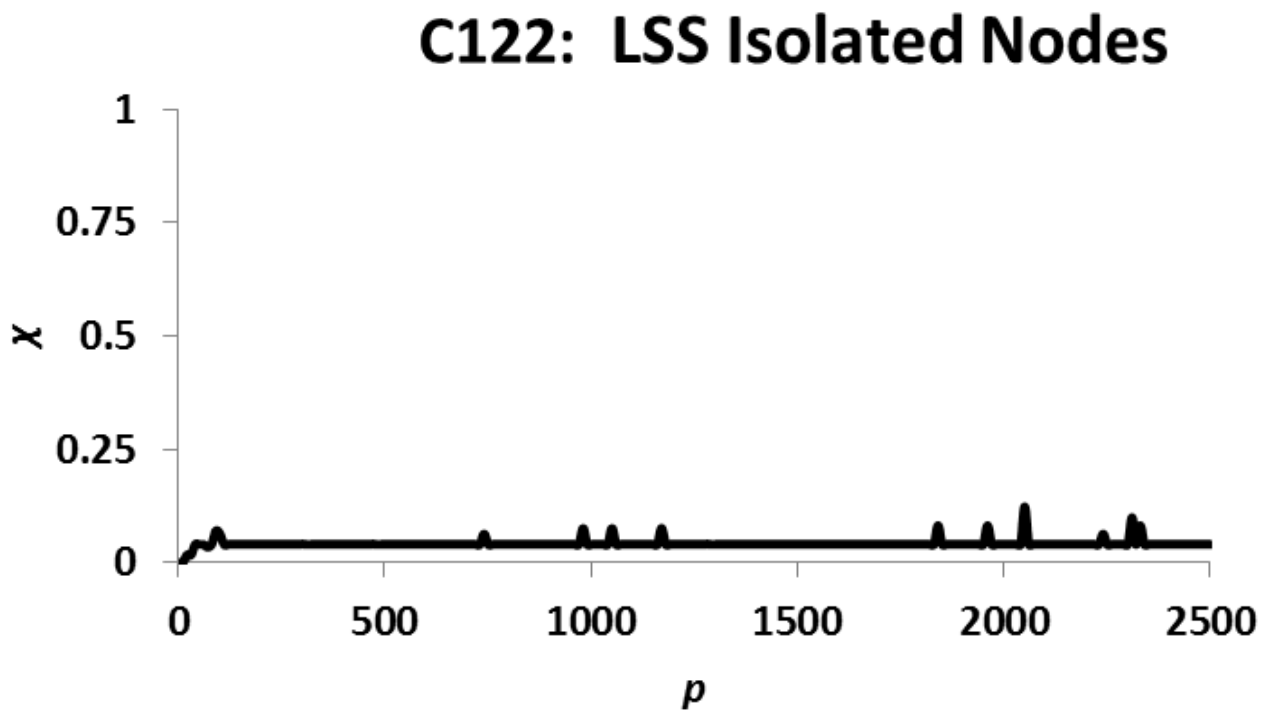


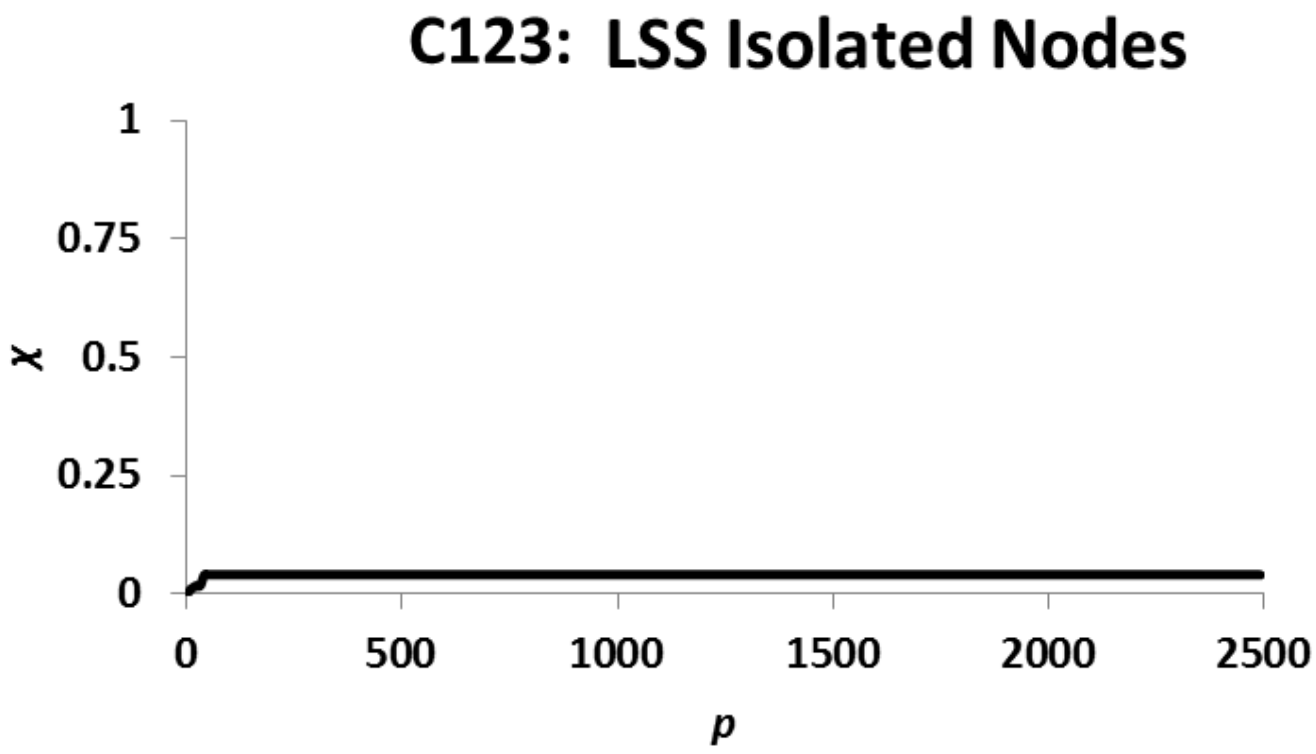

C114: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

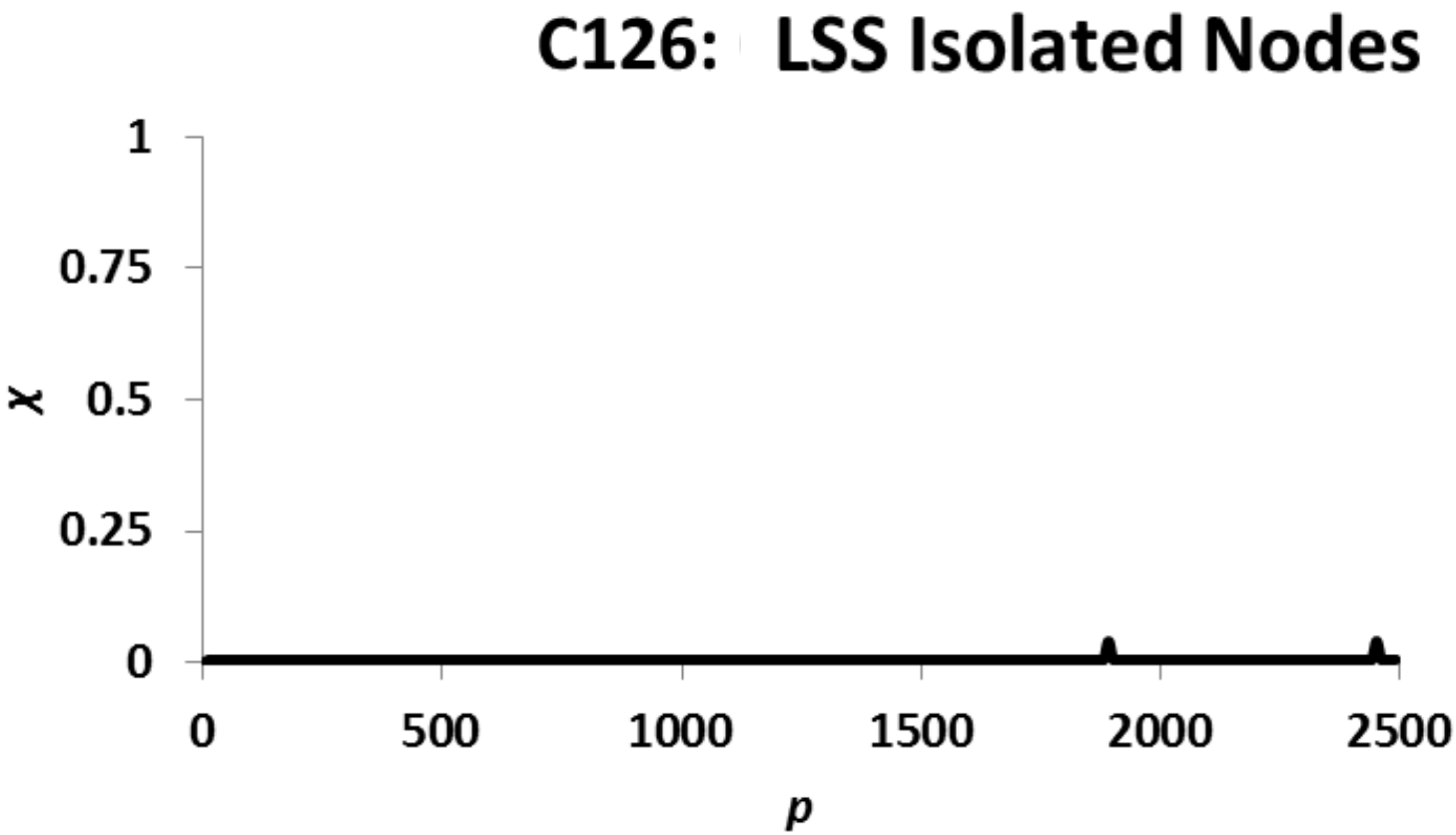

C115: LSS Isolated Nodes
1
0.75
0.5
0.25
0
ϰ
0
500
1000
1500
2000
2500
p

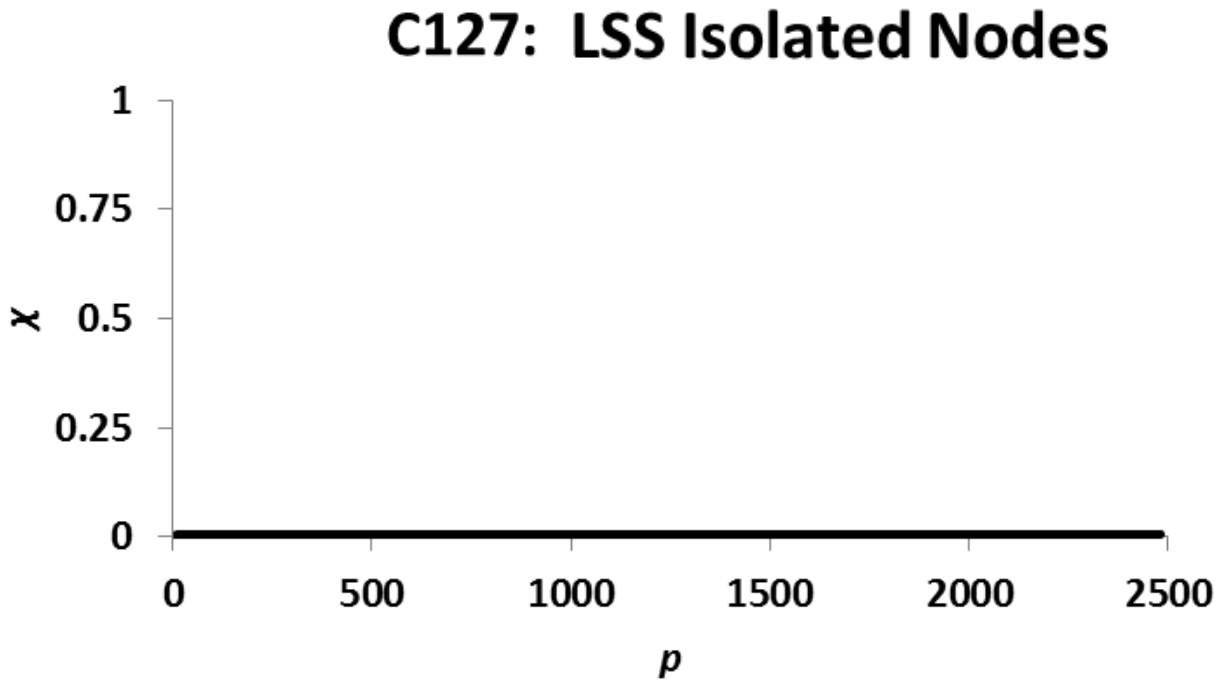

C118: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p


C119: LSS Isolated Nodes
1
0.75
0.5
0.25
0
ϰ
0
500
1000
1500
2000
2500
p


C122: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

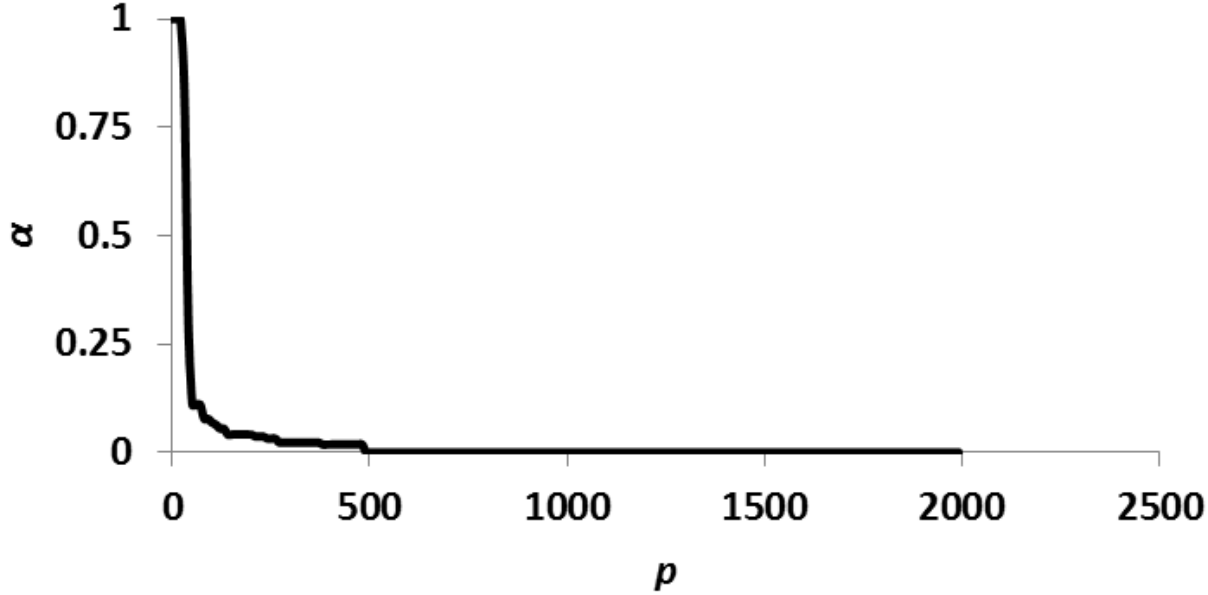

C123: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p


C126: LSS Isolated Nodes
1
0.75
0.5
0.25
0
ϰ
0
500
1000
1500
2000
2500
p

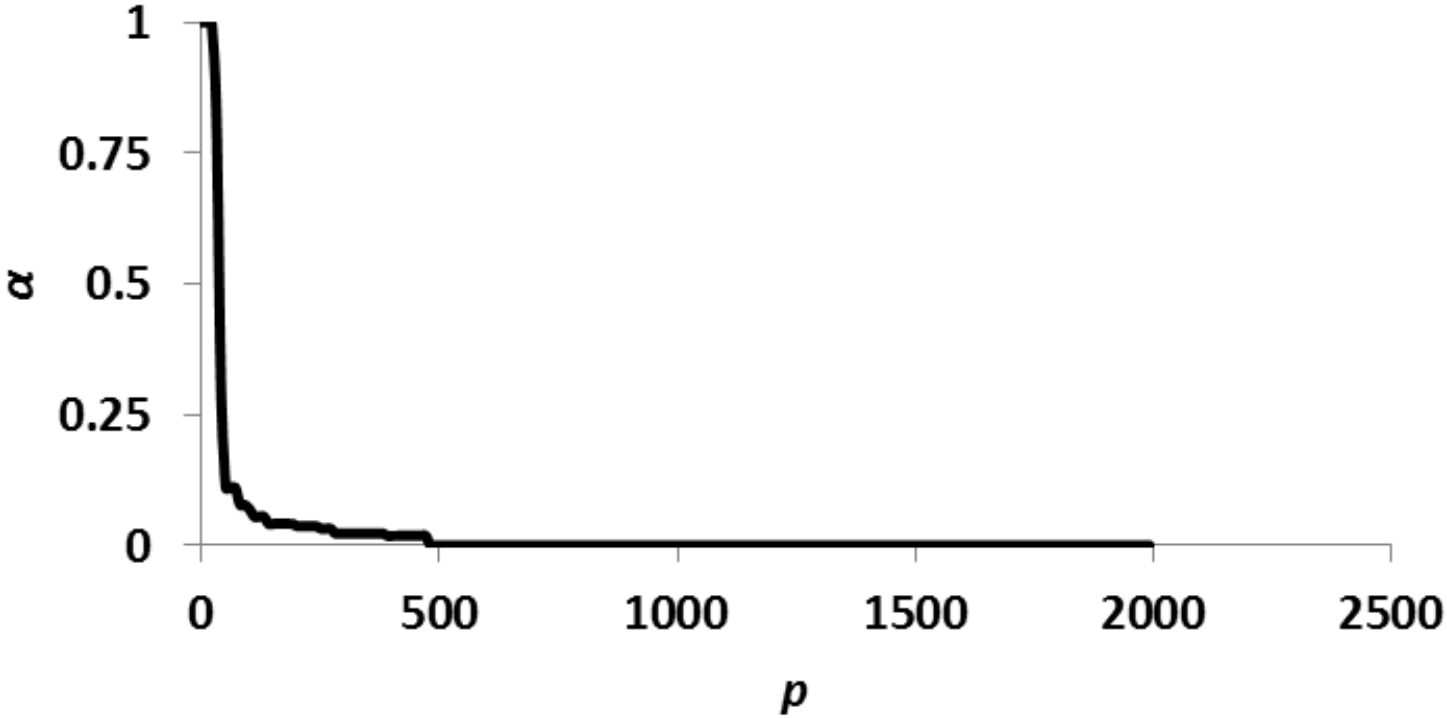

C127: LSS Isolated Nodes
1
0.75
0.5
0.25
0
χ
0
500
1000
1500
2000
2500
p

Graphs for Network Connectivity (α) Figure 22
(Dabrowski & Mills NIST)

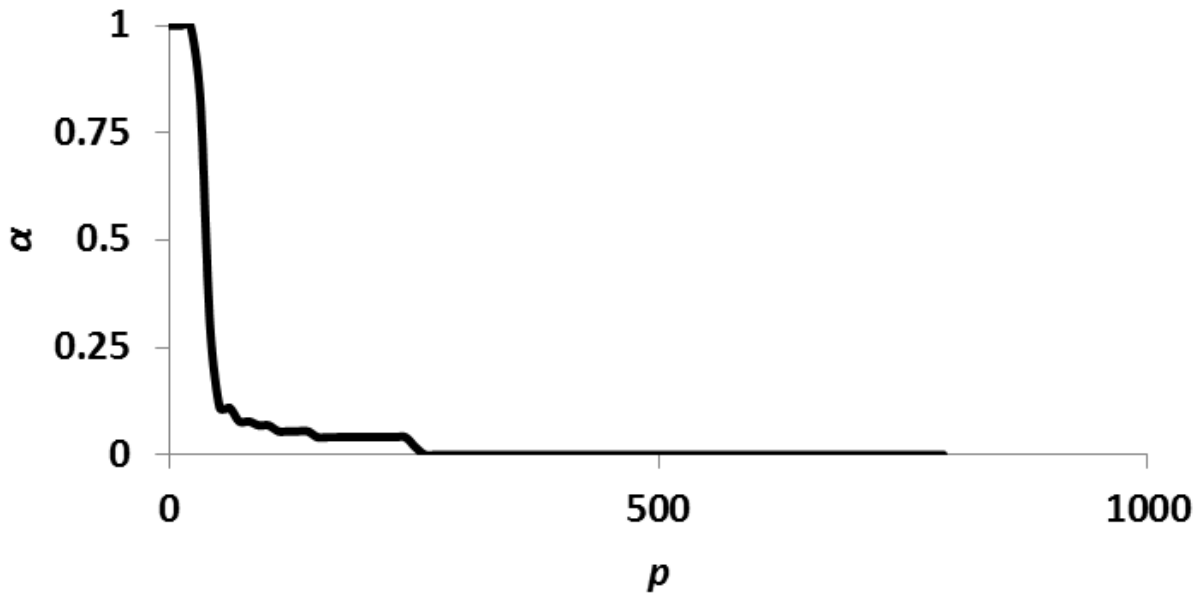
C0: LSS Reachable Nodes



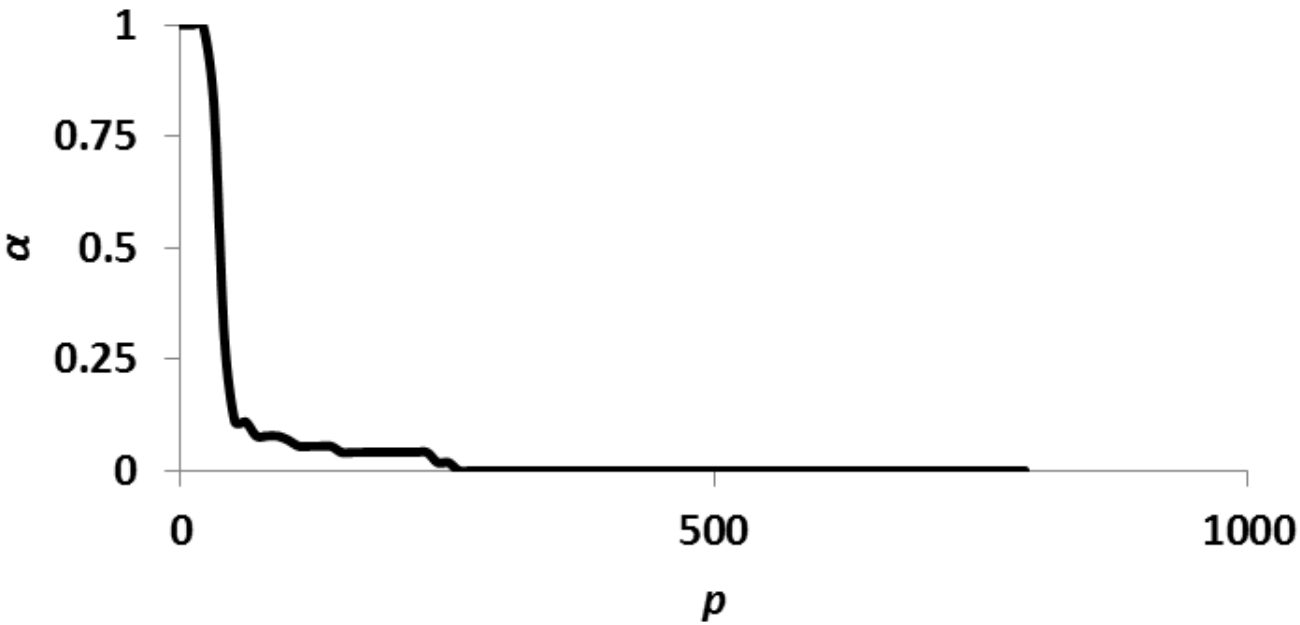
C1: LSS Reachable Nodes



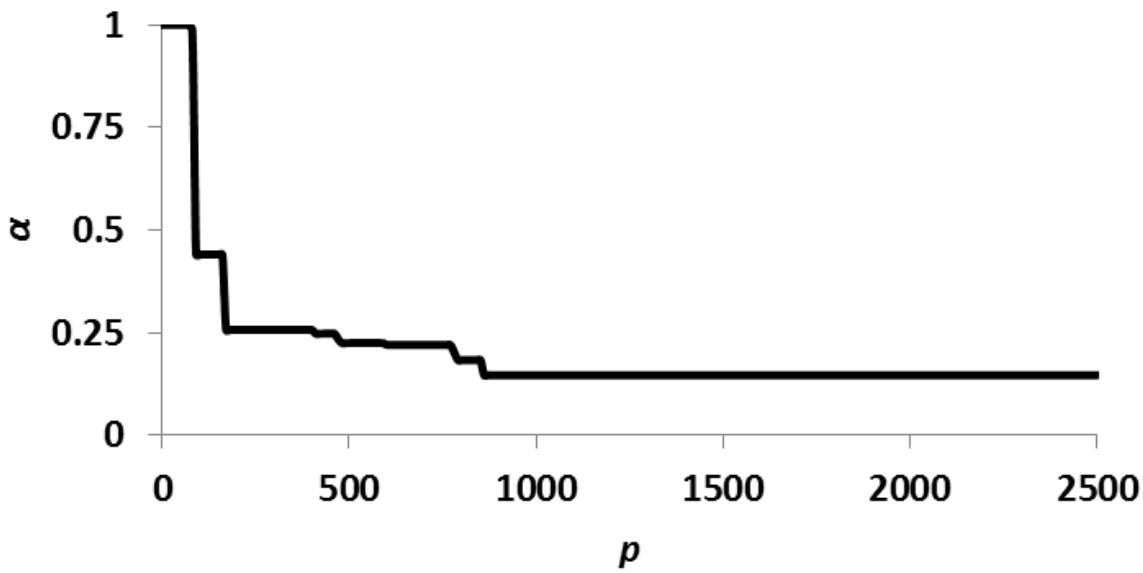
C2: LSS Reachable Nodes



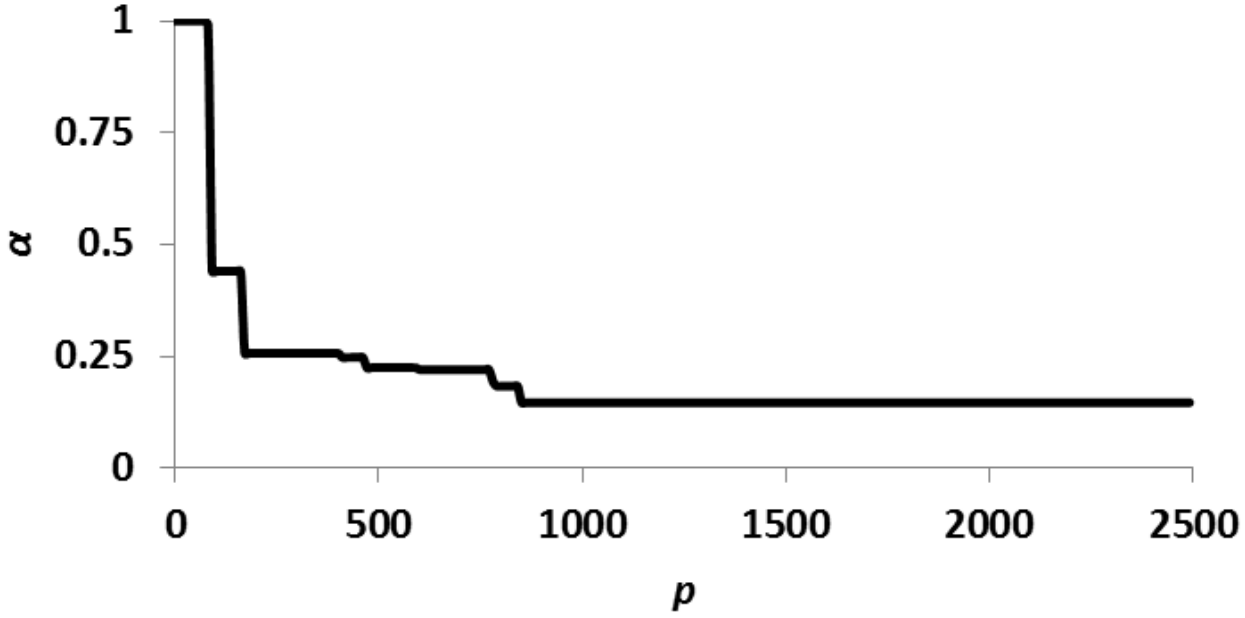
C3: LSS Reachable Nodes



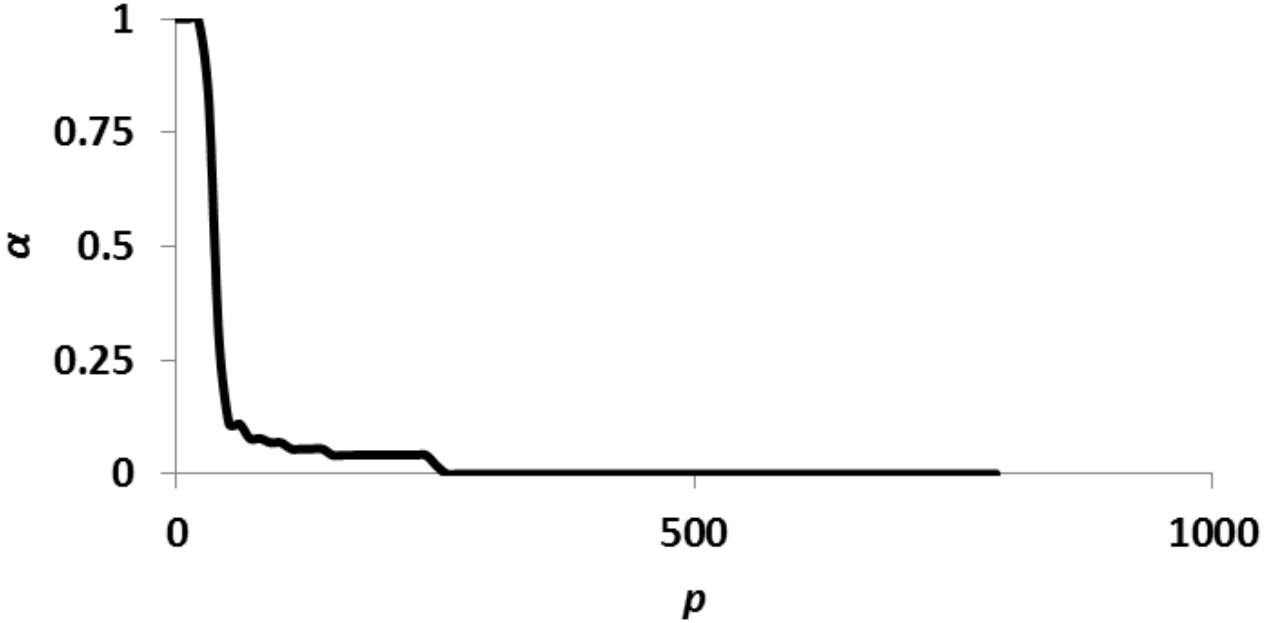
C6: LSS Reachable Nodes



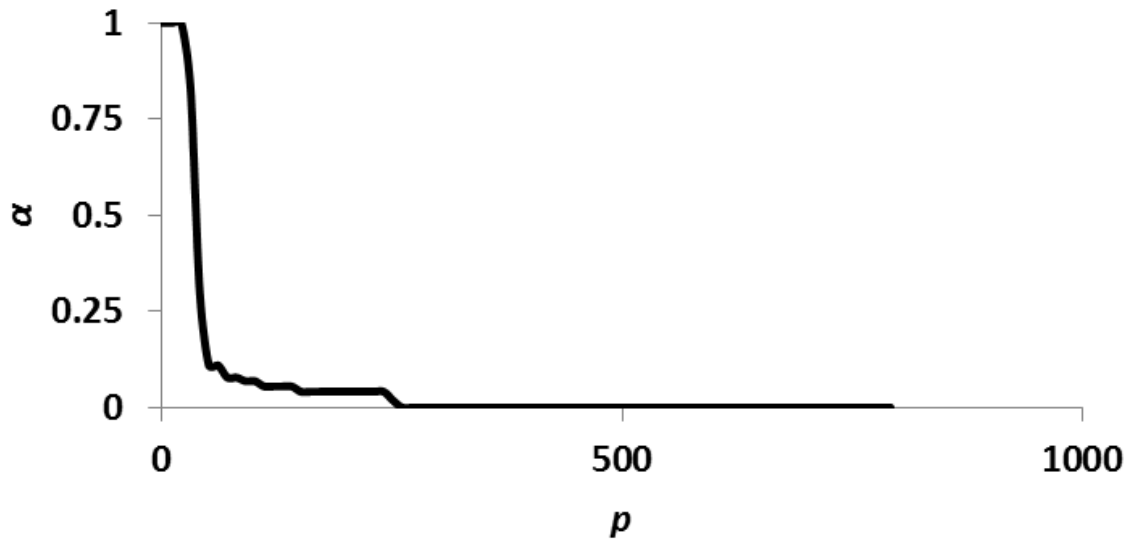
C7: LSS Reachable Nodes



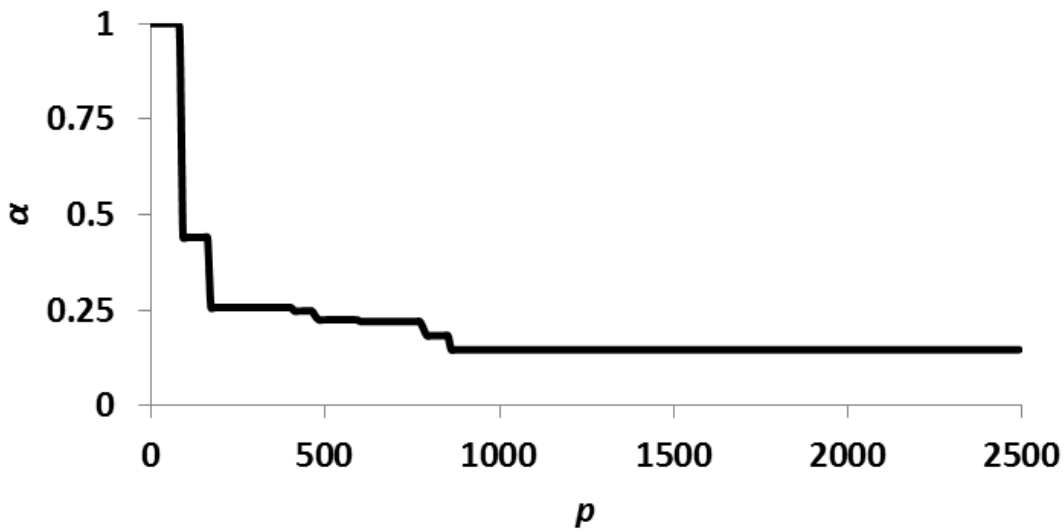
C10: LSS Reachable Nodes



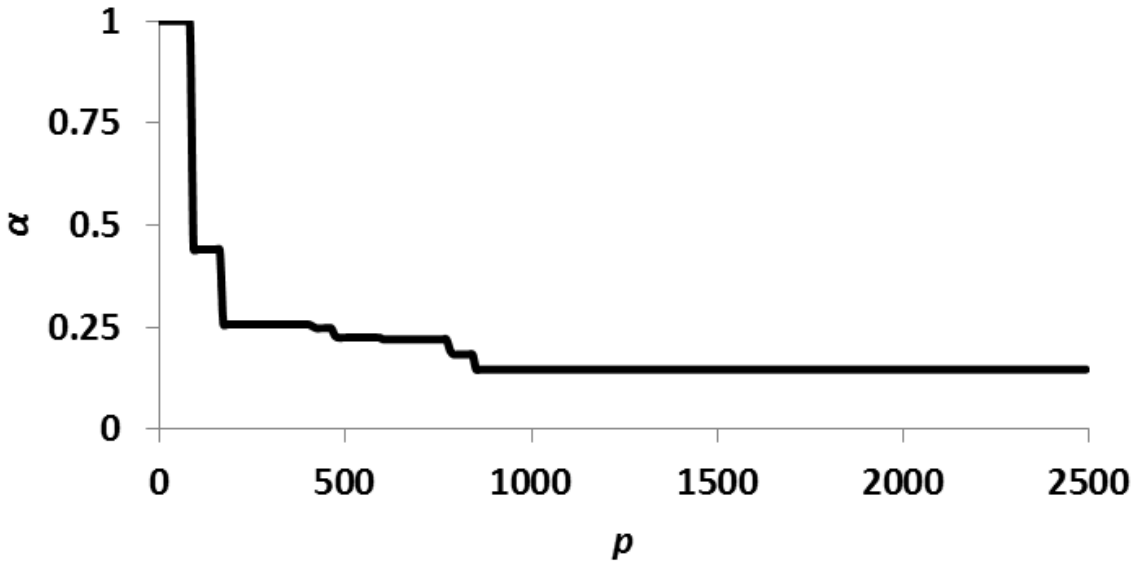
C11: LSS Reachable Nodes



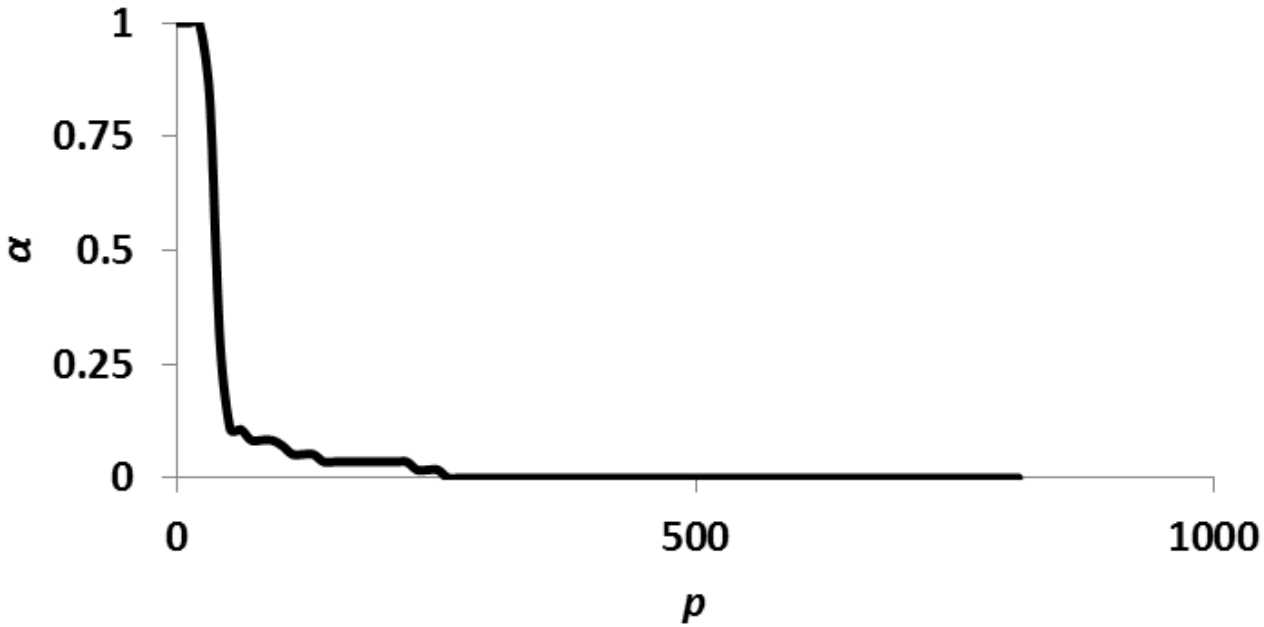
C14: LSS Reachable Nodes



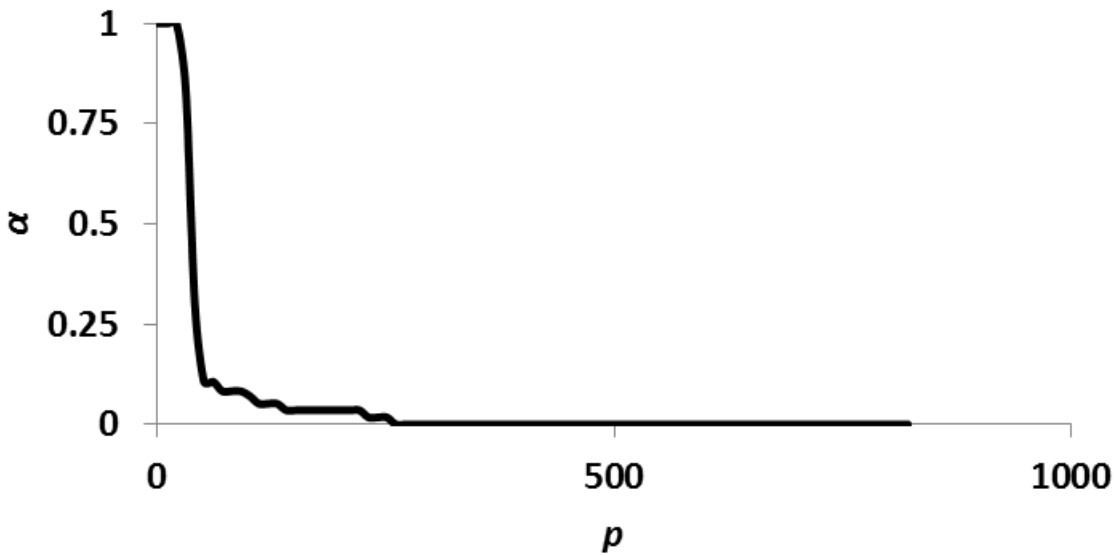
C15: LSS Reachable Nodes



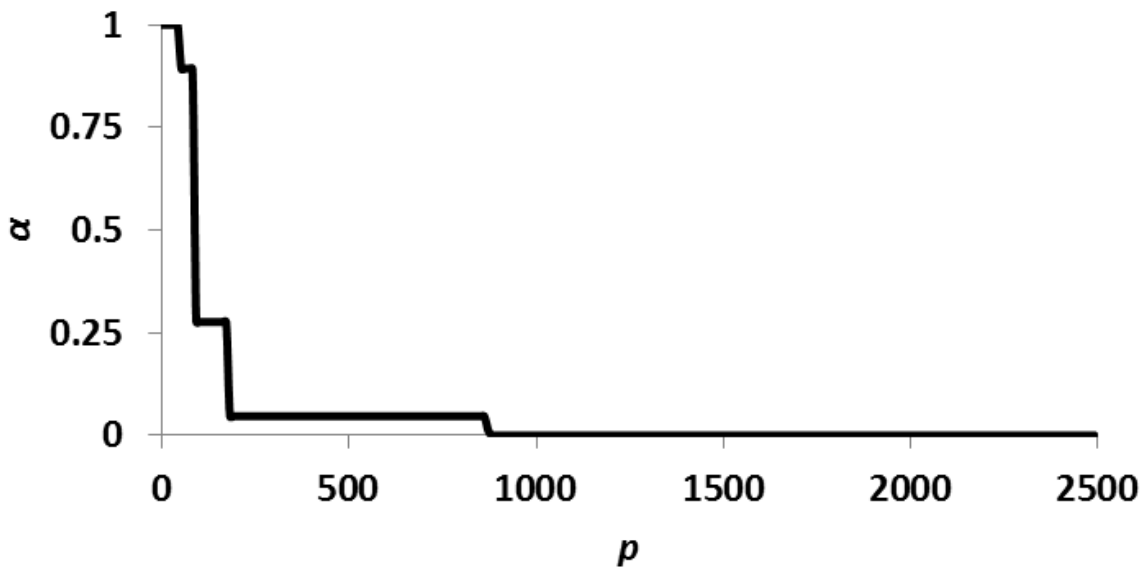
C18: LSS Reachable Nodes



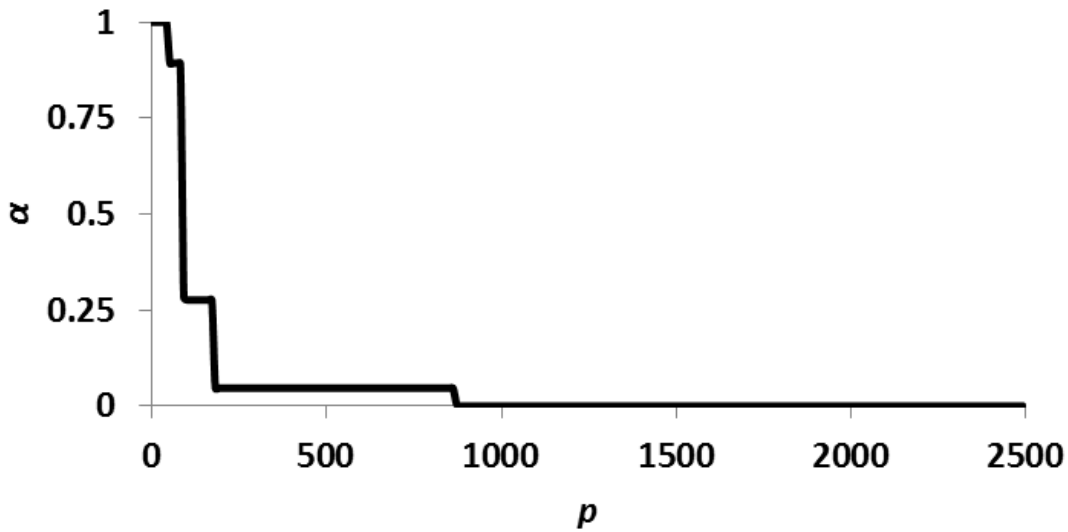
C19: LSS Reachable Nodes



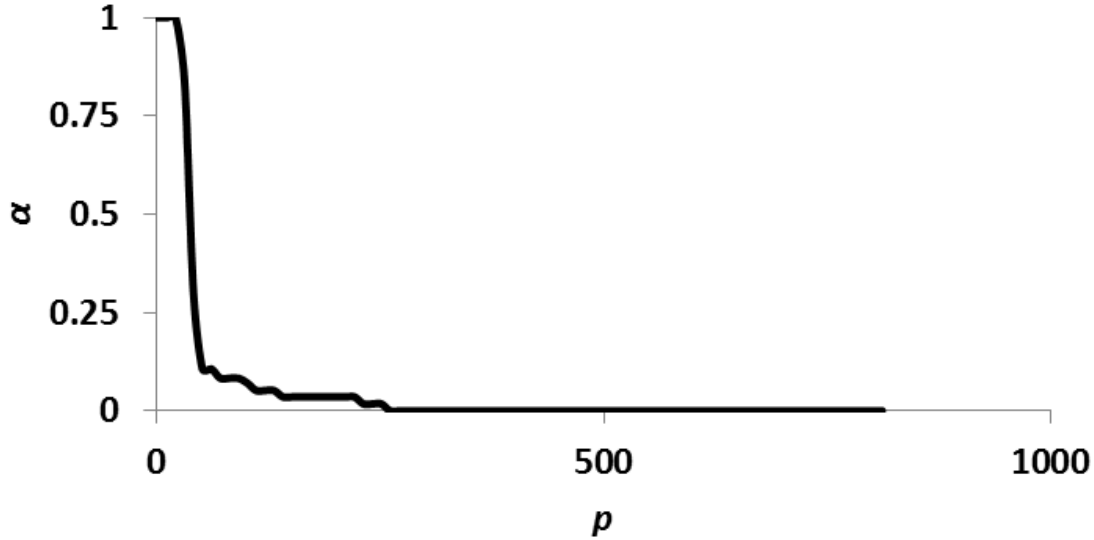
C22: LSS Reachable Nodes



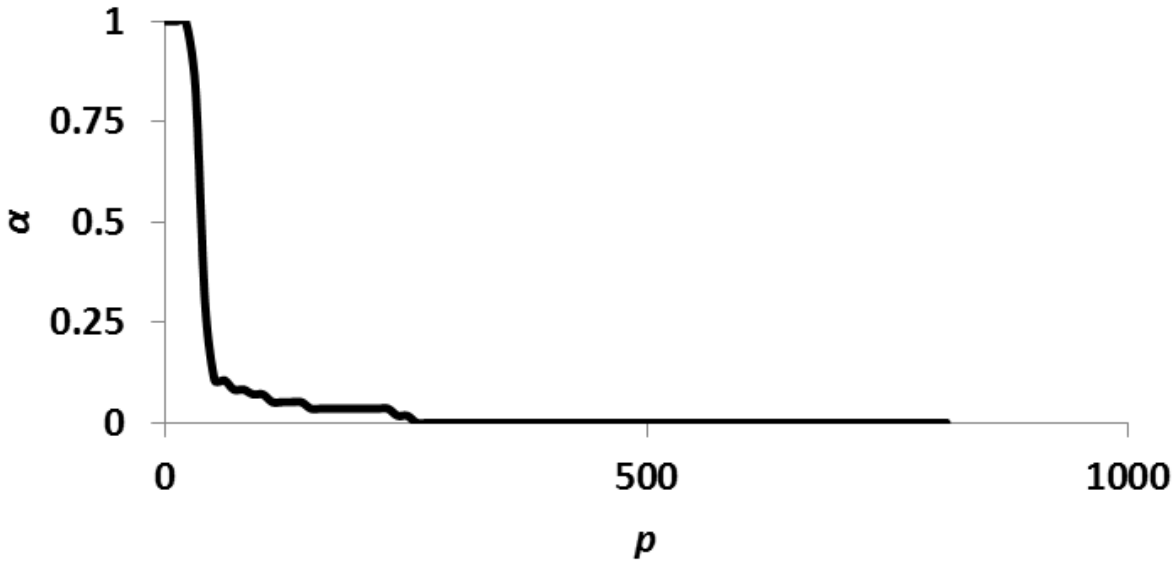
C23: LSS Reachable Nodes



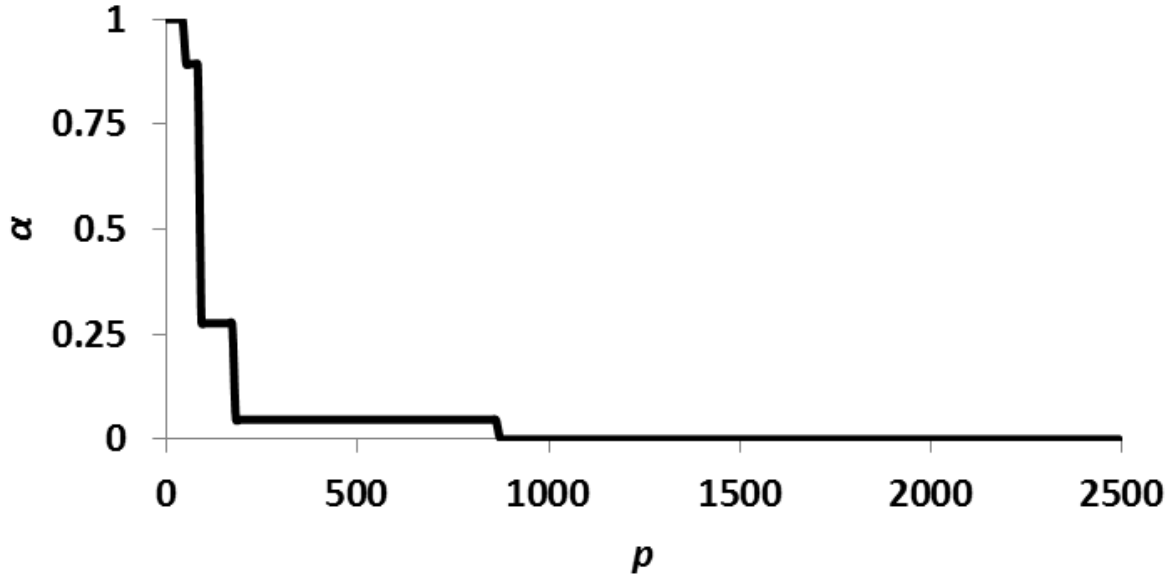
C26: LSS Reachable Nodes



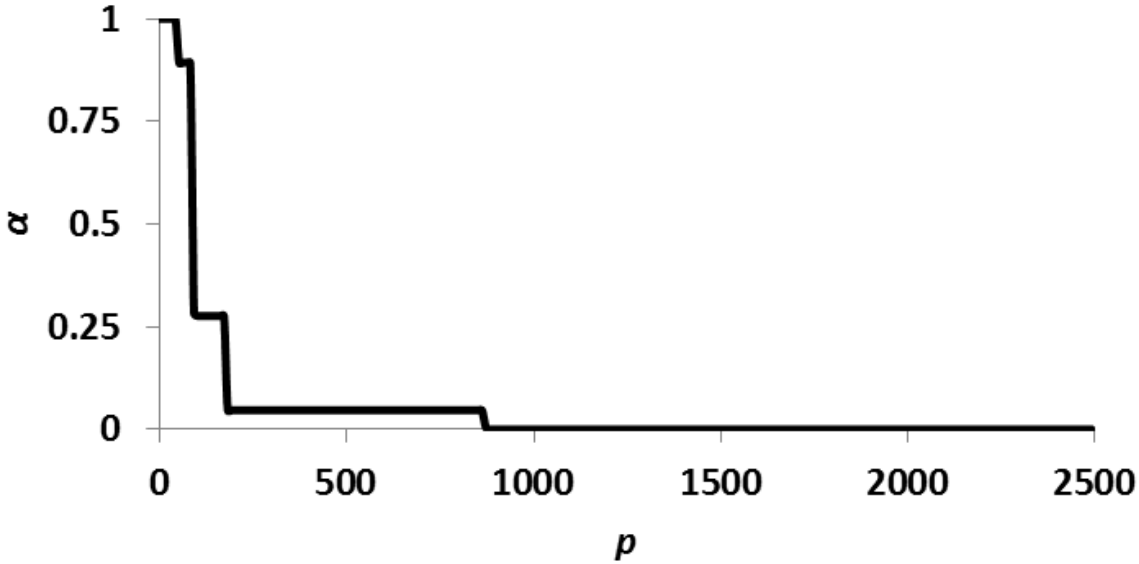
C27: LSS Reachable Nodes



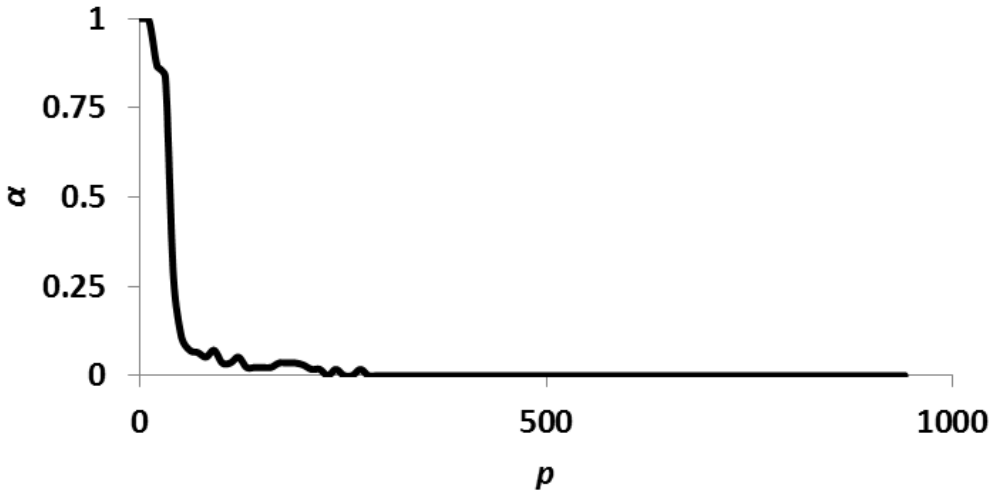
C30: LSS Reachable Nodes



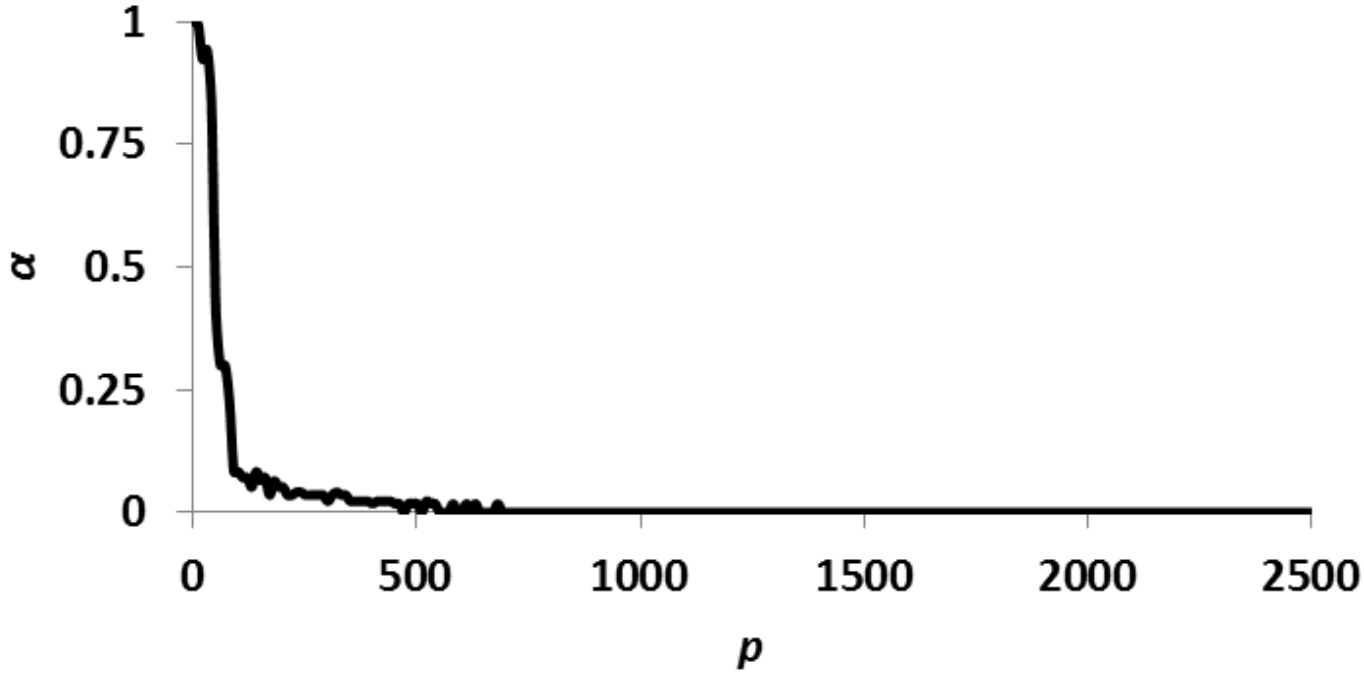
C31: LSS Reachable Nodes



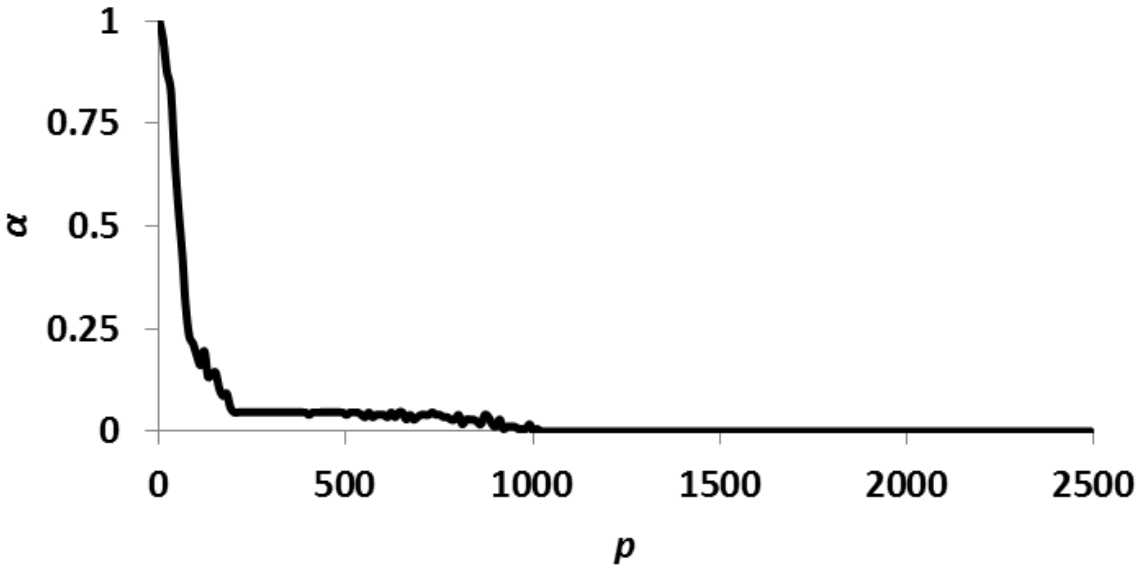
C50: LSS Reachable Nodes



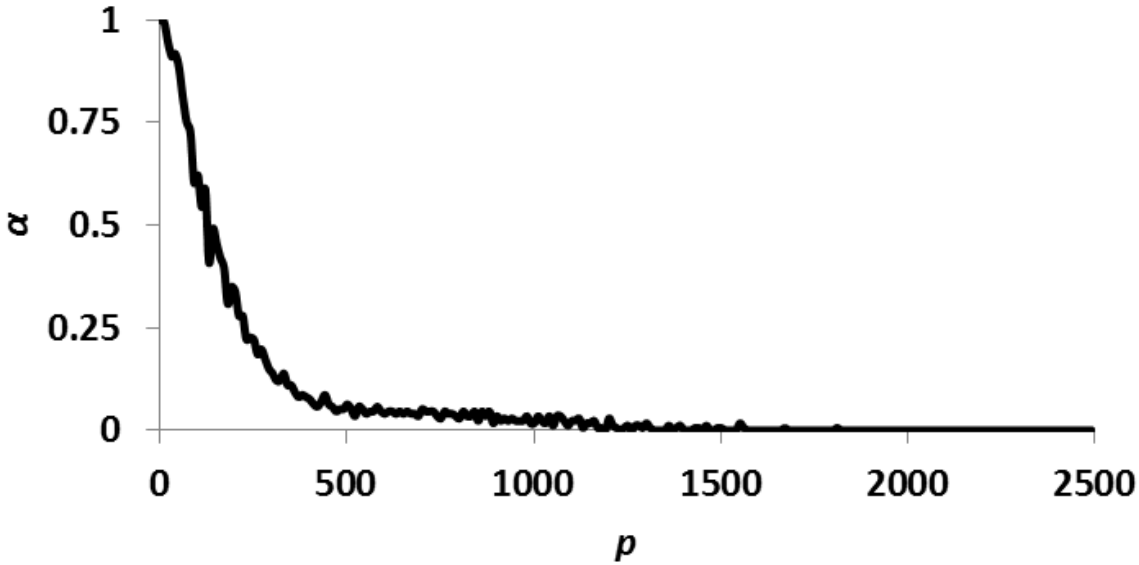
C51: LSS Reachable Nodes



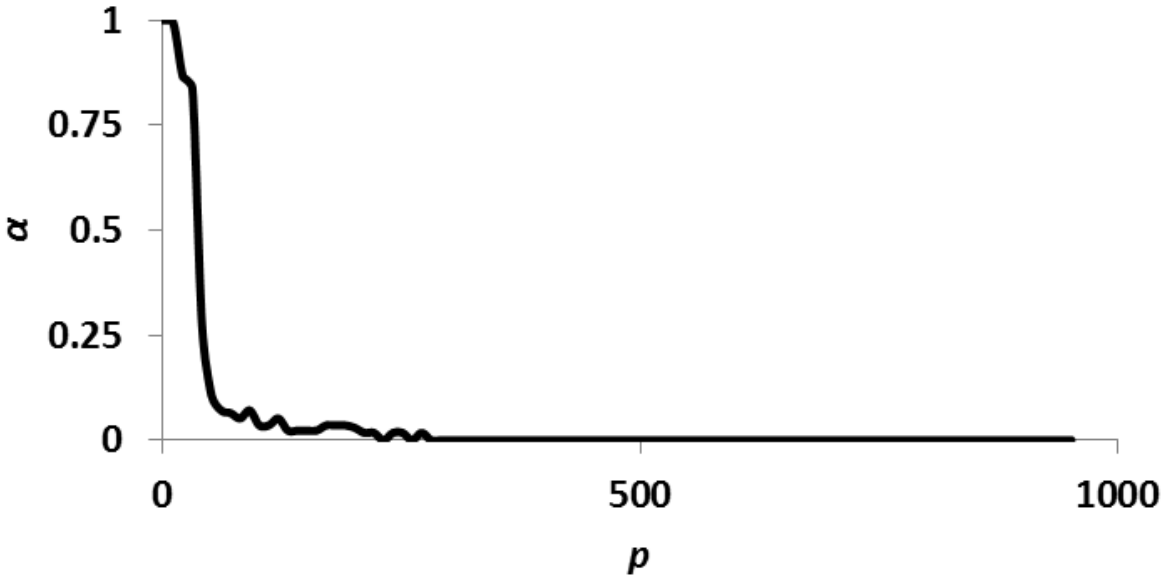
C54: LSS Reachable Nodes



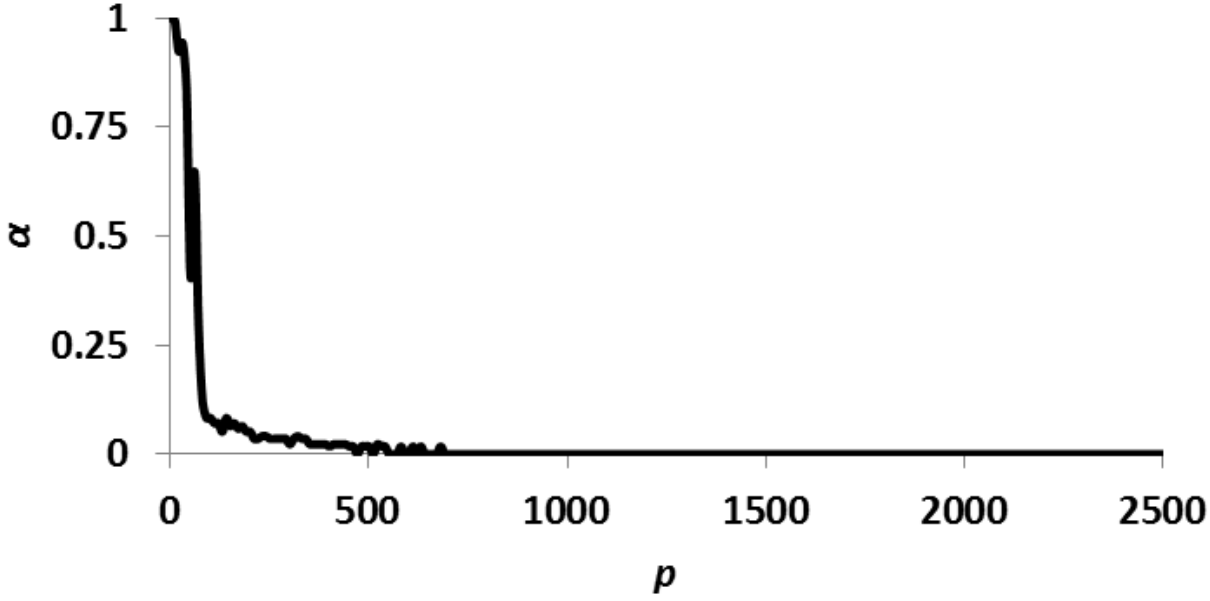
C55: LSS Reachable Nodes



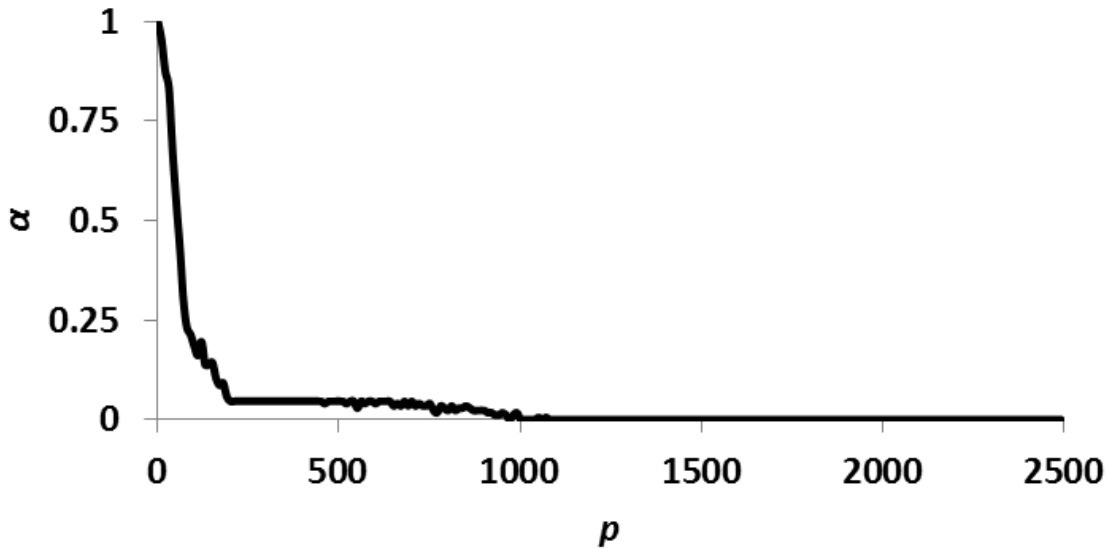
C58: LSS Reachable Nodes



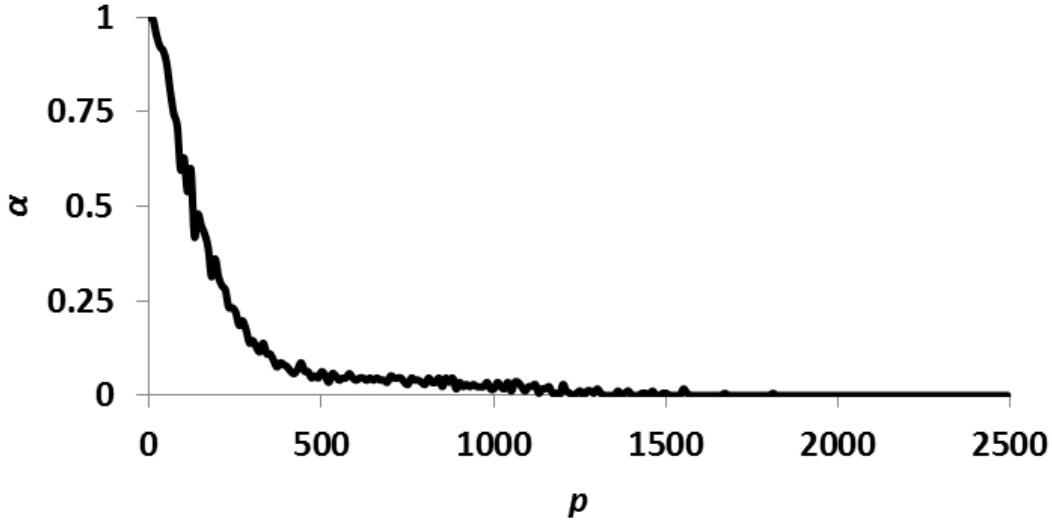
C59: LSS Reachable Nodes



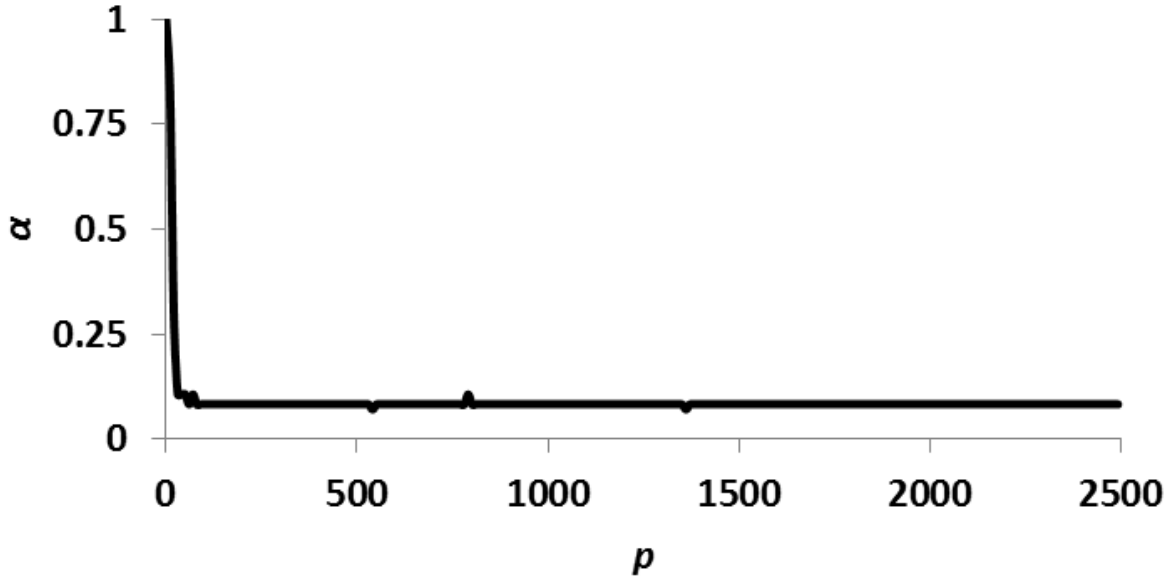
C62: LSS Reachable Nodes



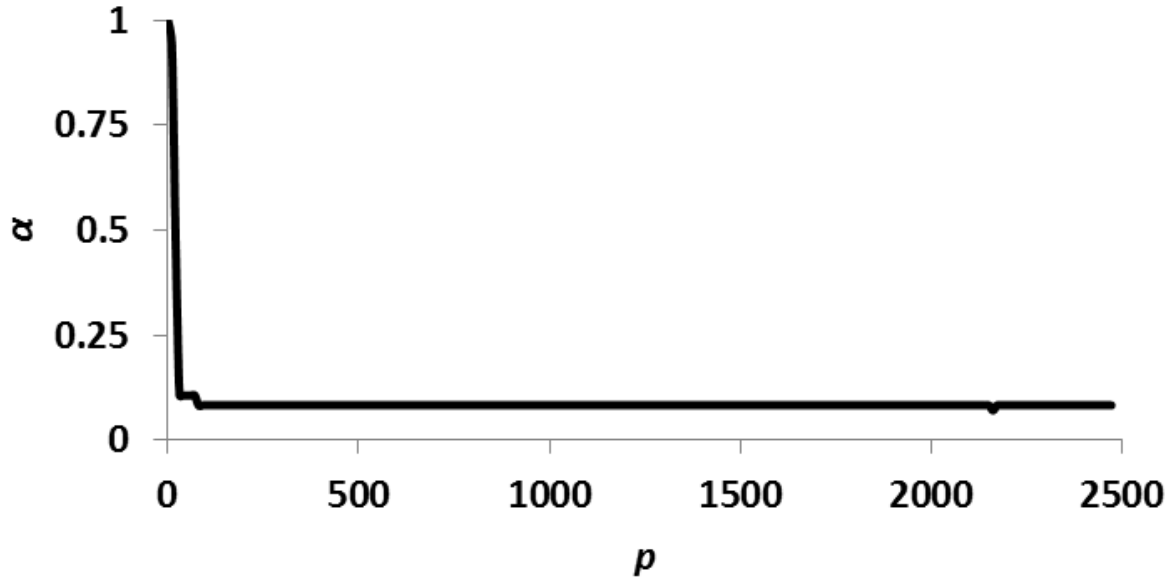
C63: LSS Reachable Nodes



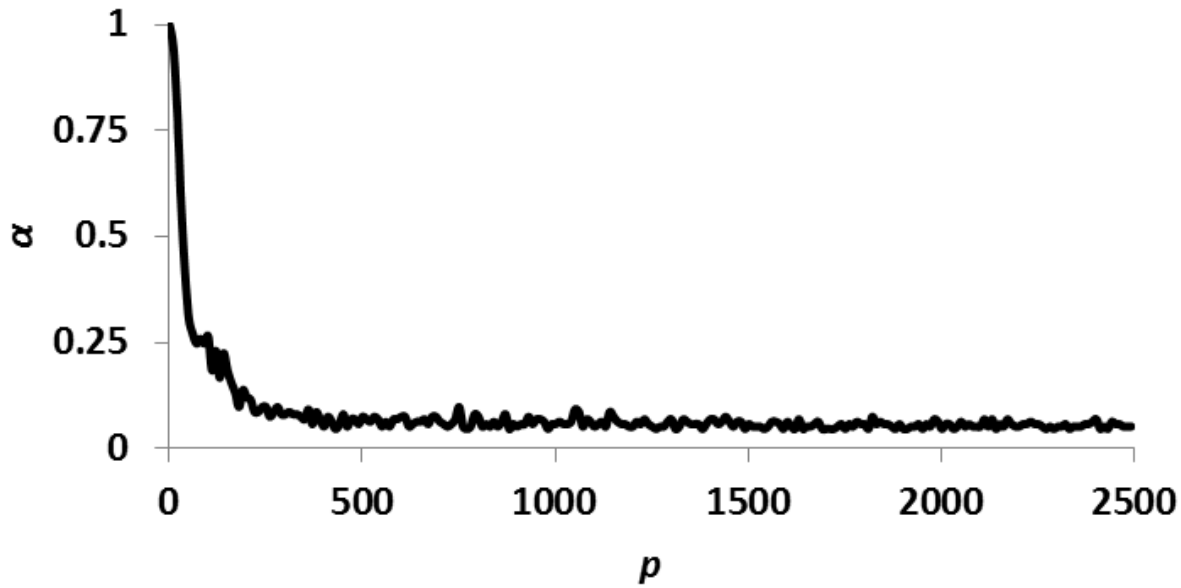
C114: LSS Reachable Nodes



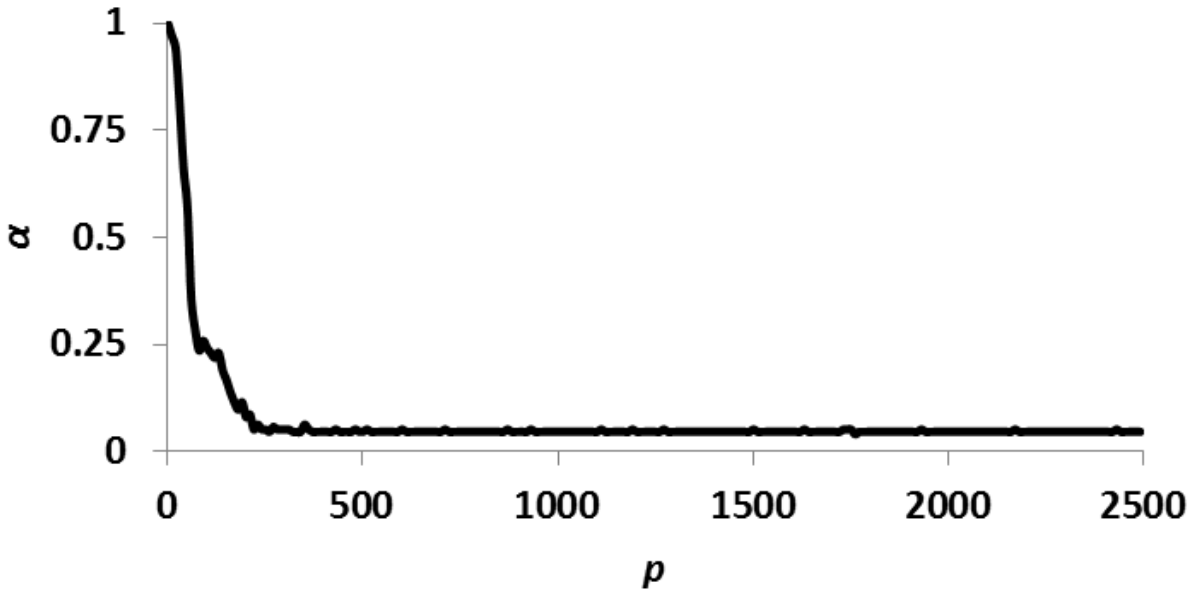
C115: LSS Reachable Nodes



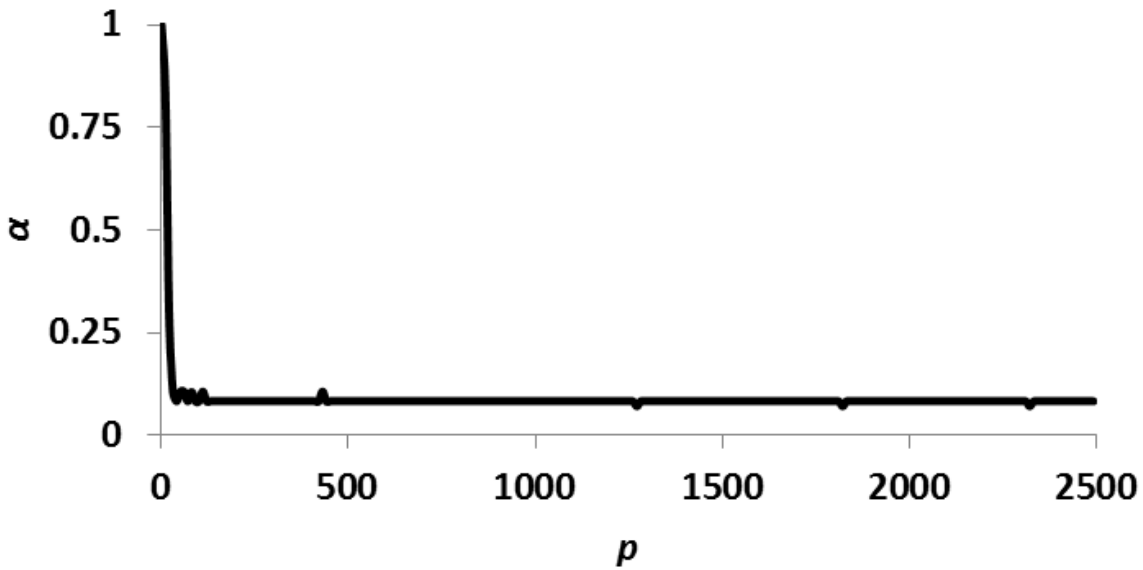
C118: LSS Reachable Nodes



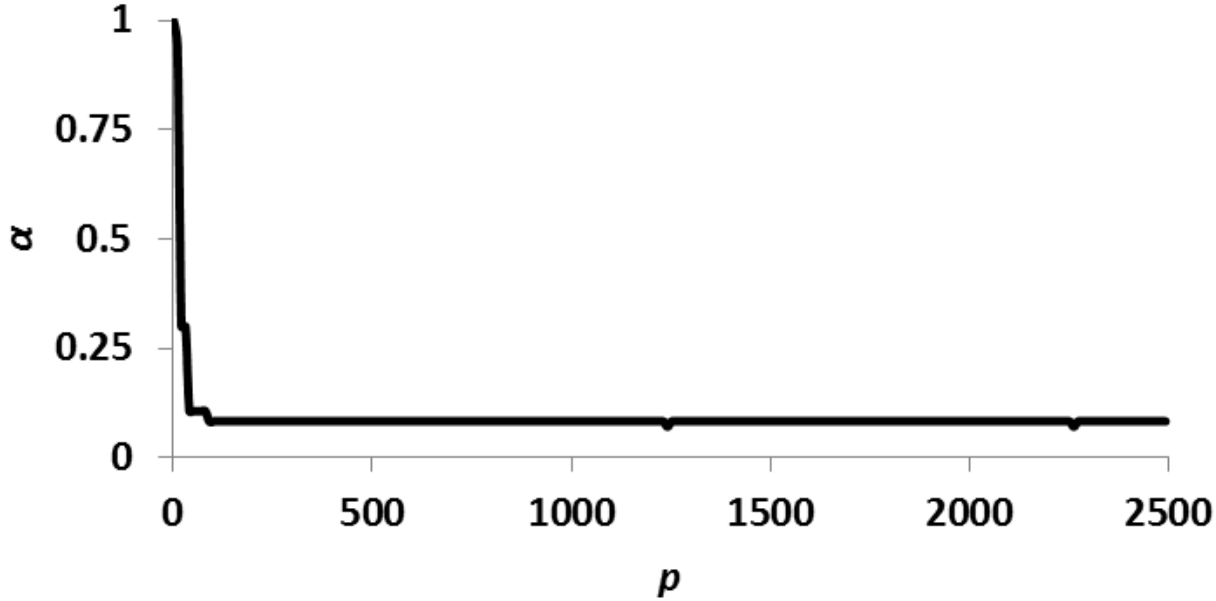
C119: LSS Reachable Nodes



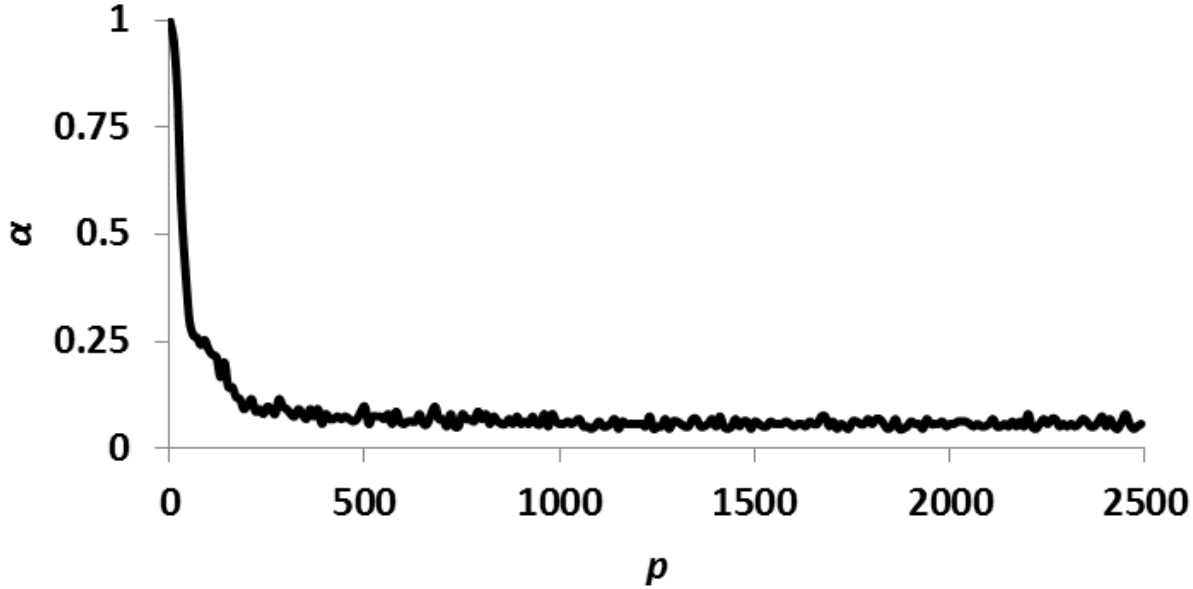
C122: LSS Reachable Nodes



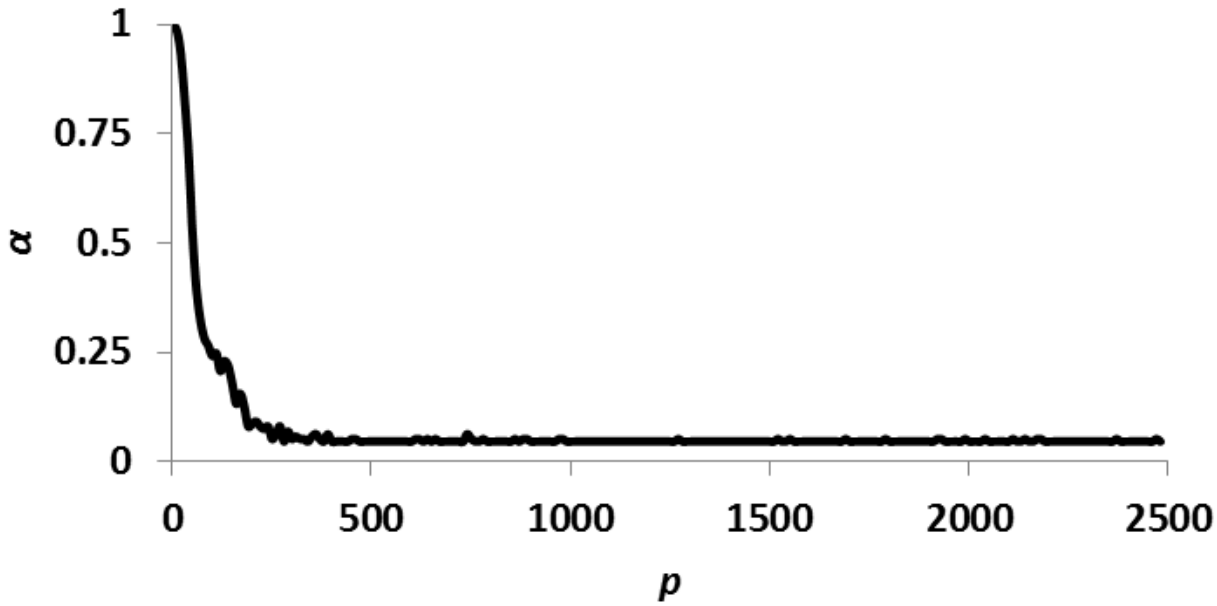
C123: LSS Reachable Nodes



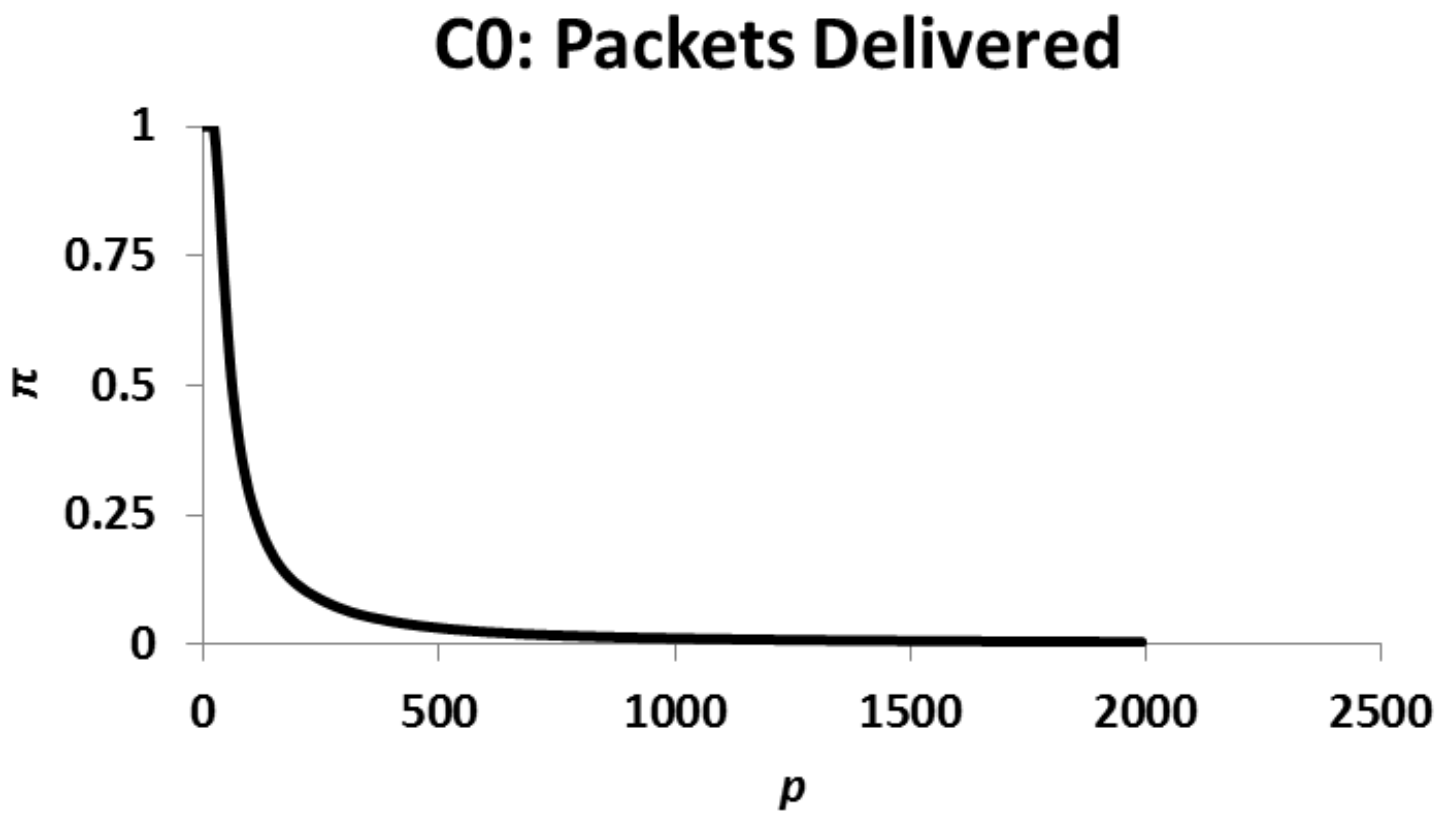
C126: LSS Reachable Nodes

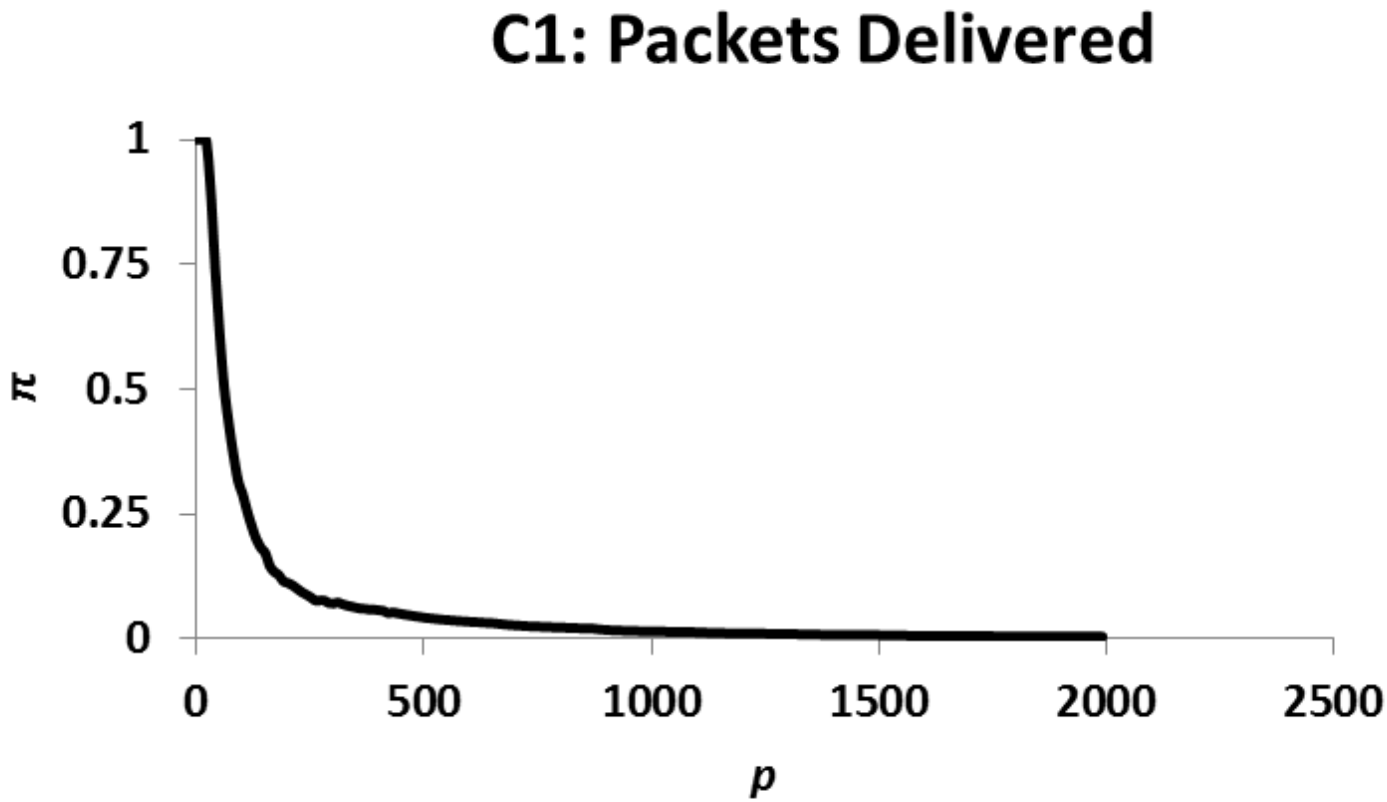


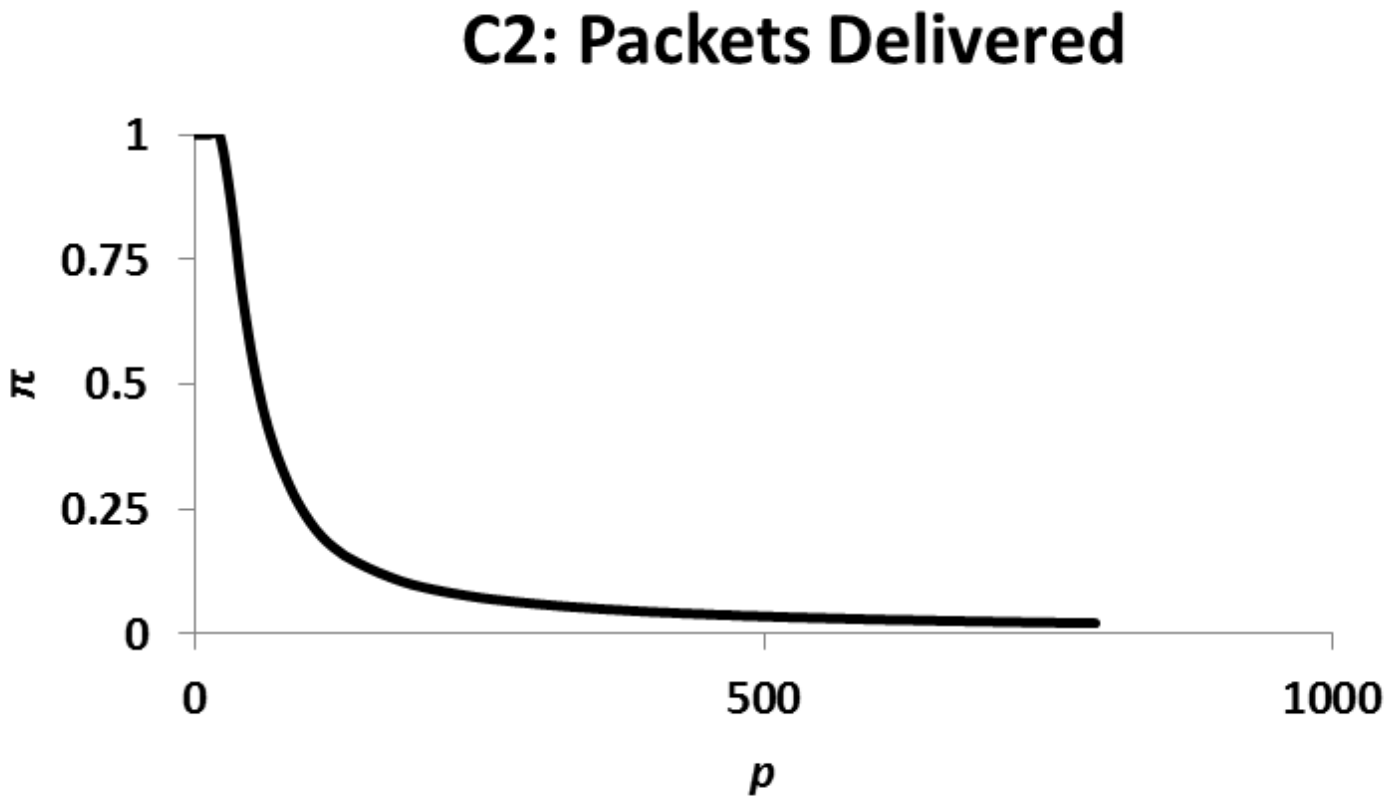
C127: LSS Reachable Nodes

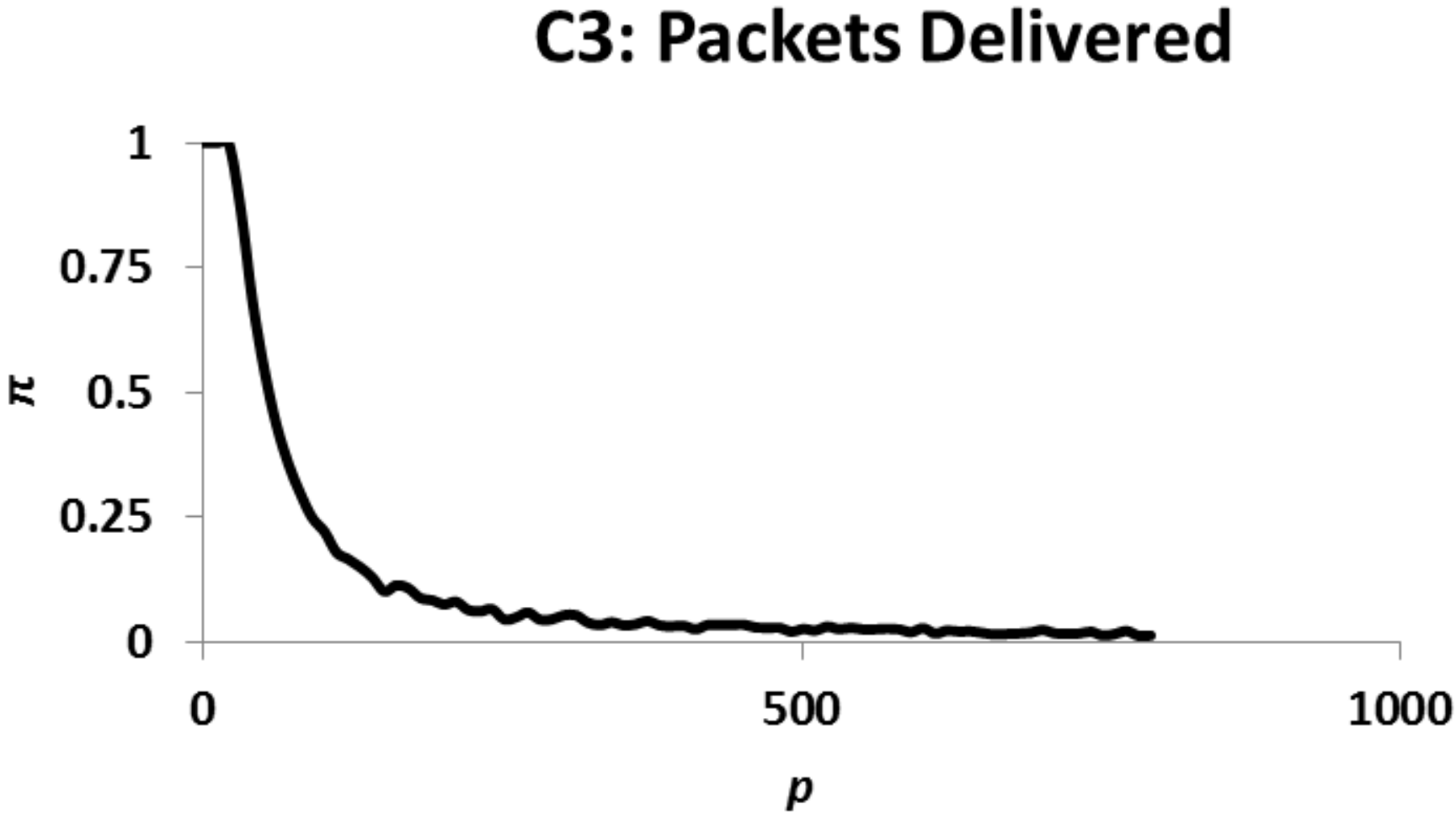


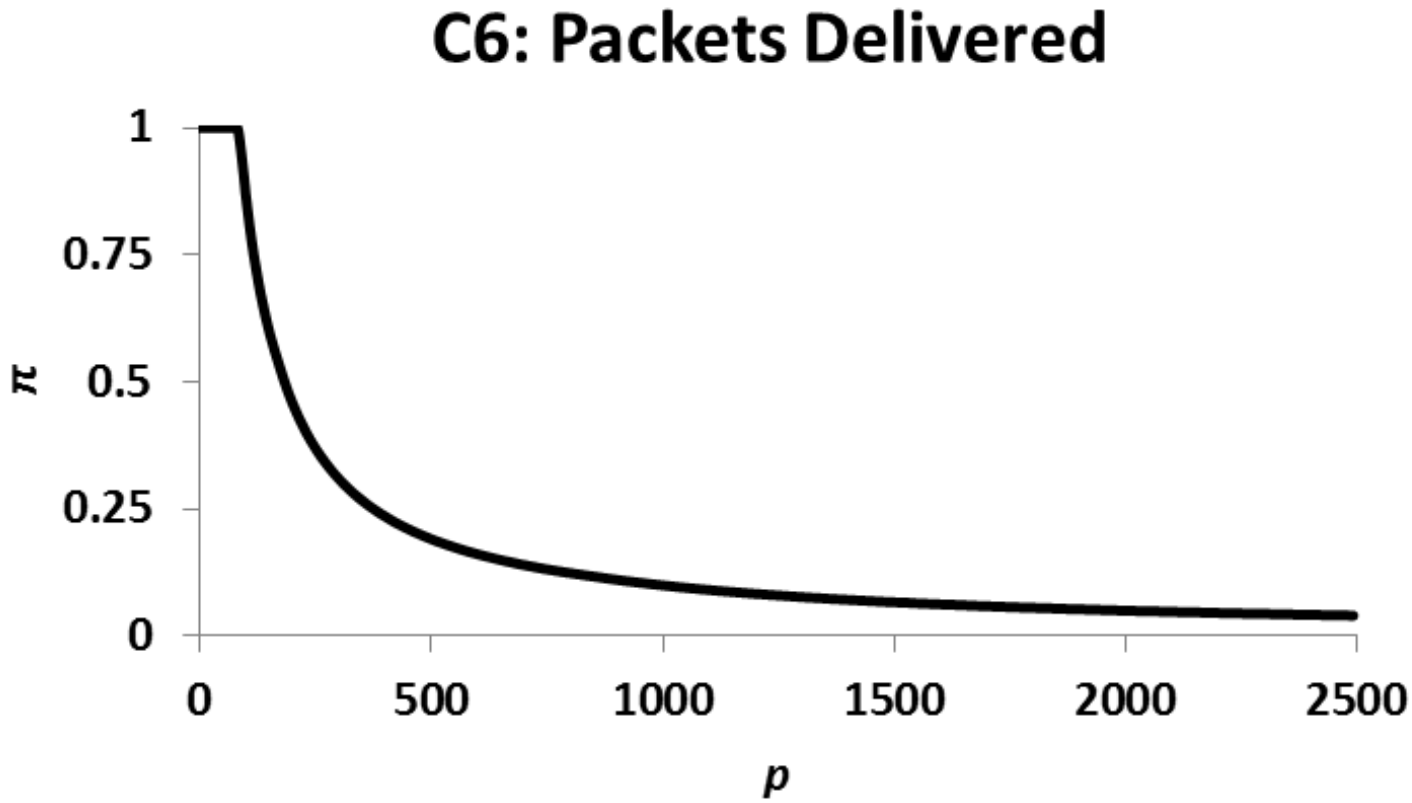
Graphs for Packet Delivery Effectiveness (π) Figure 23
(Dabrowski & Mills NIST)

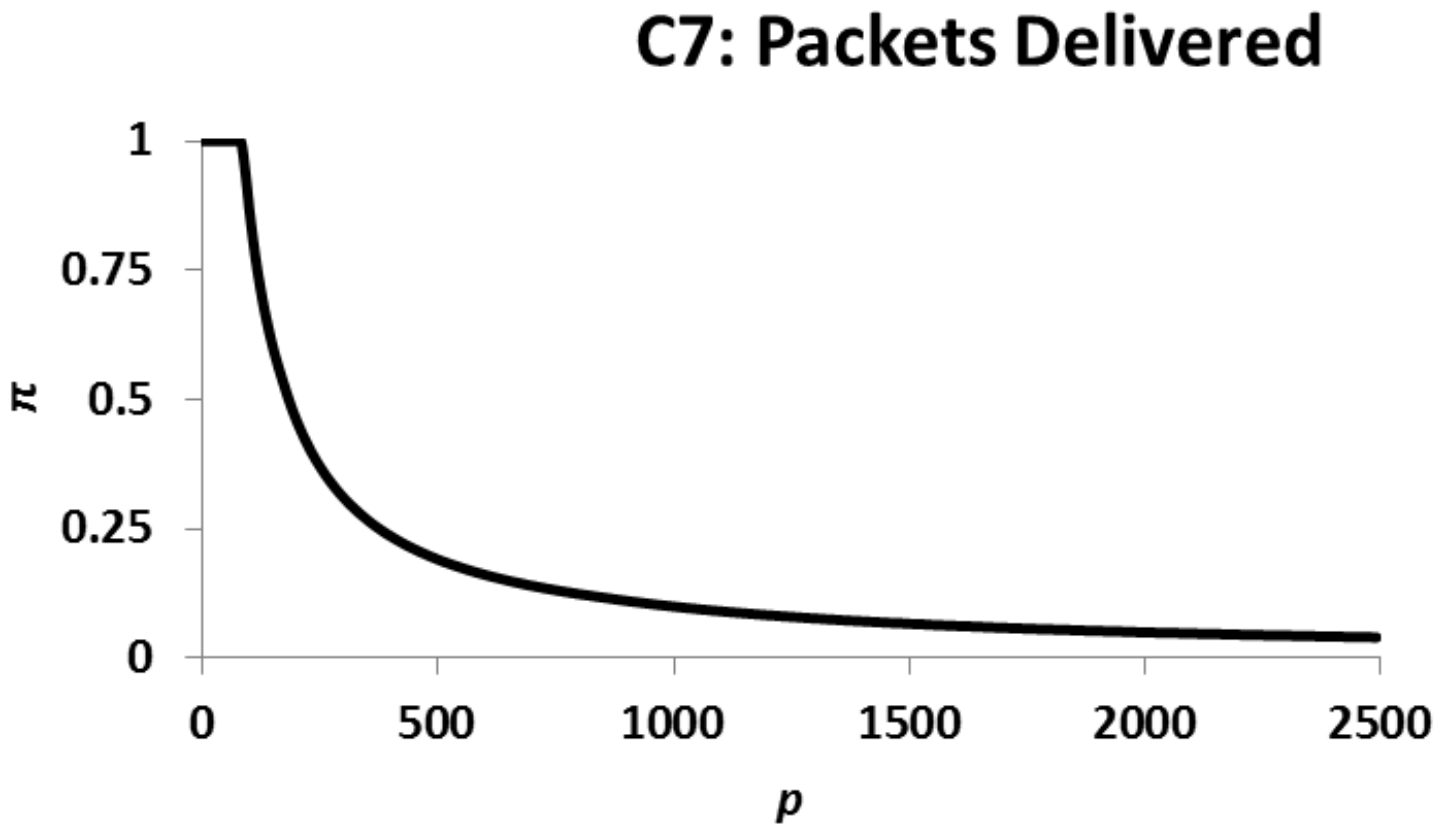

C0: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

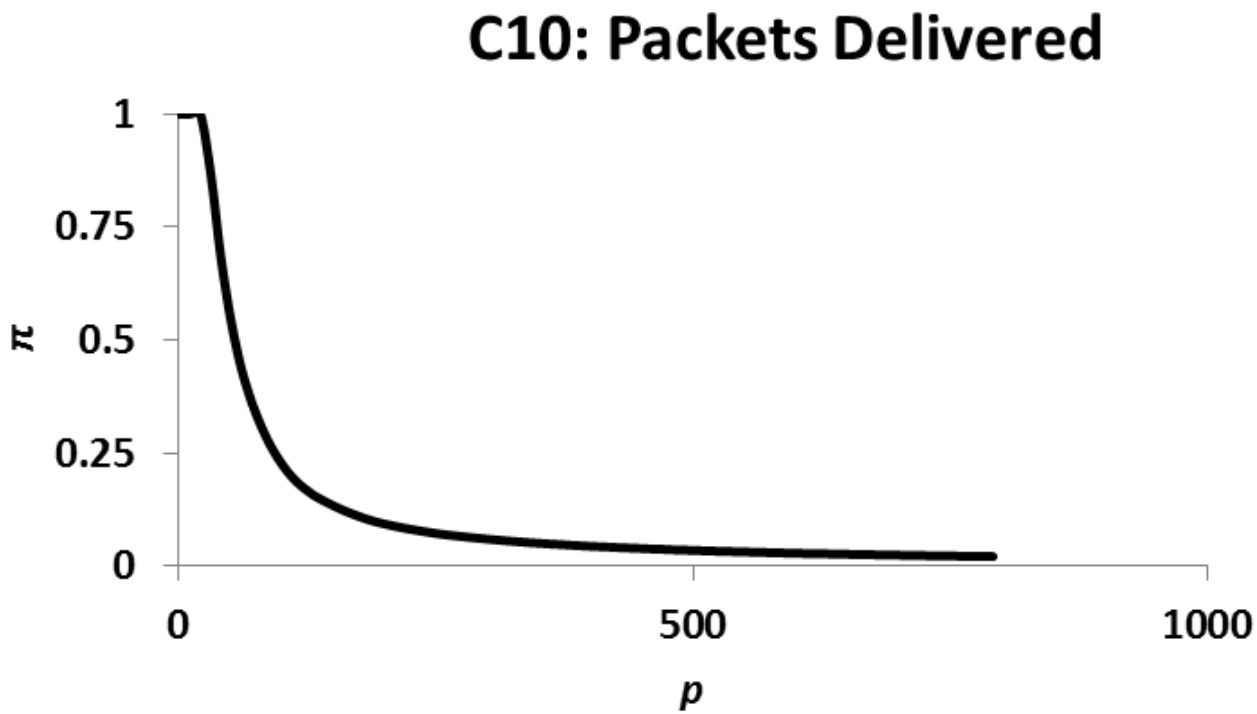

C1: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

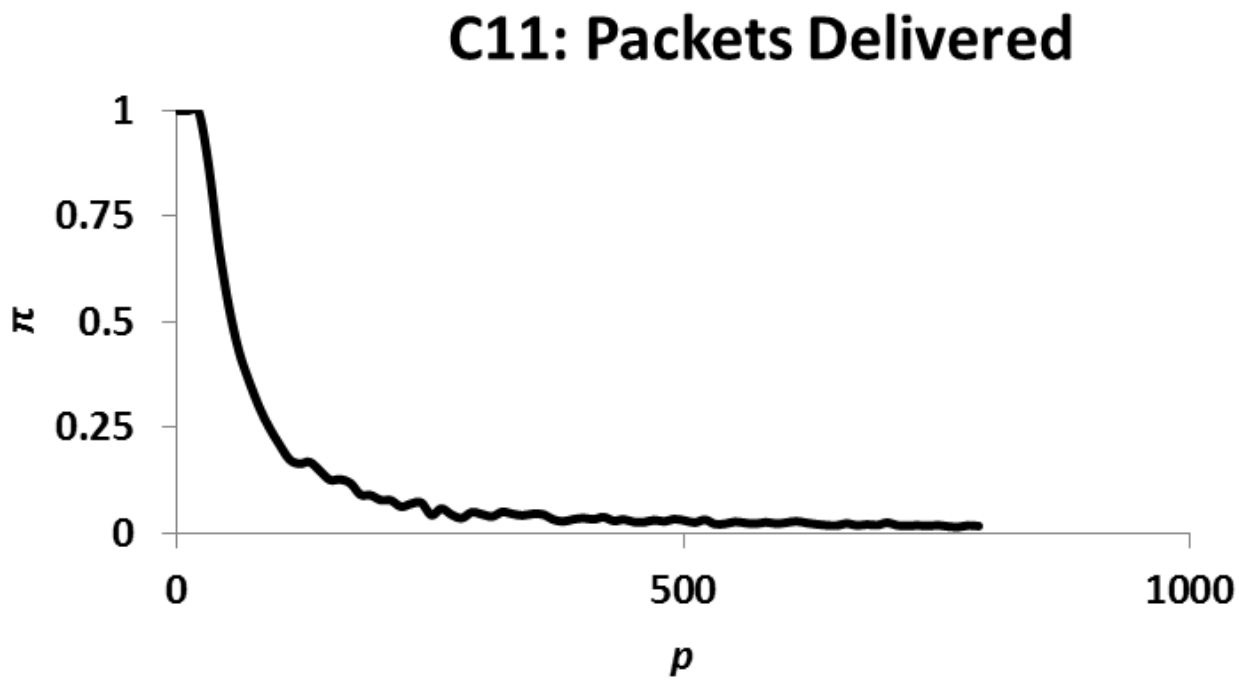

C2: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

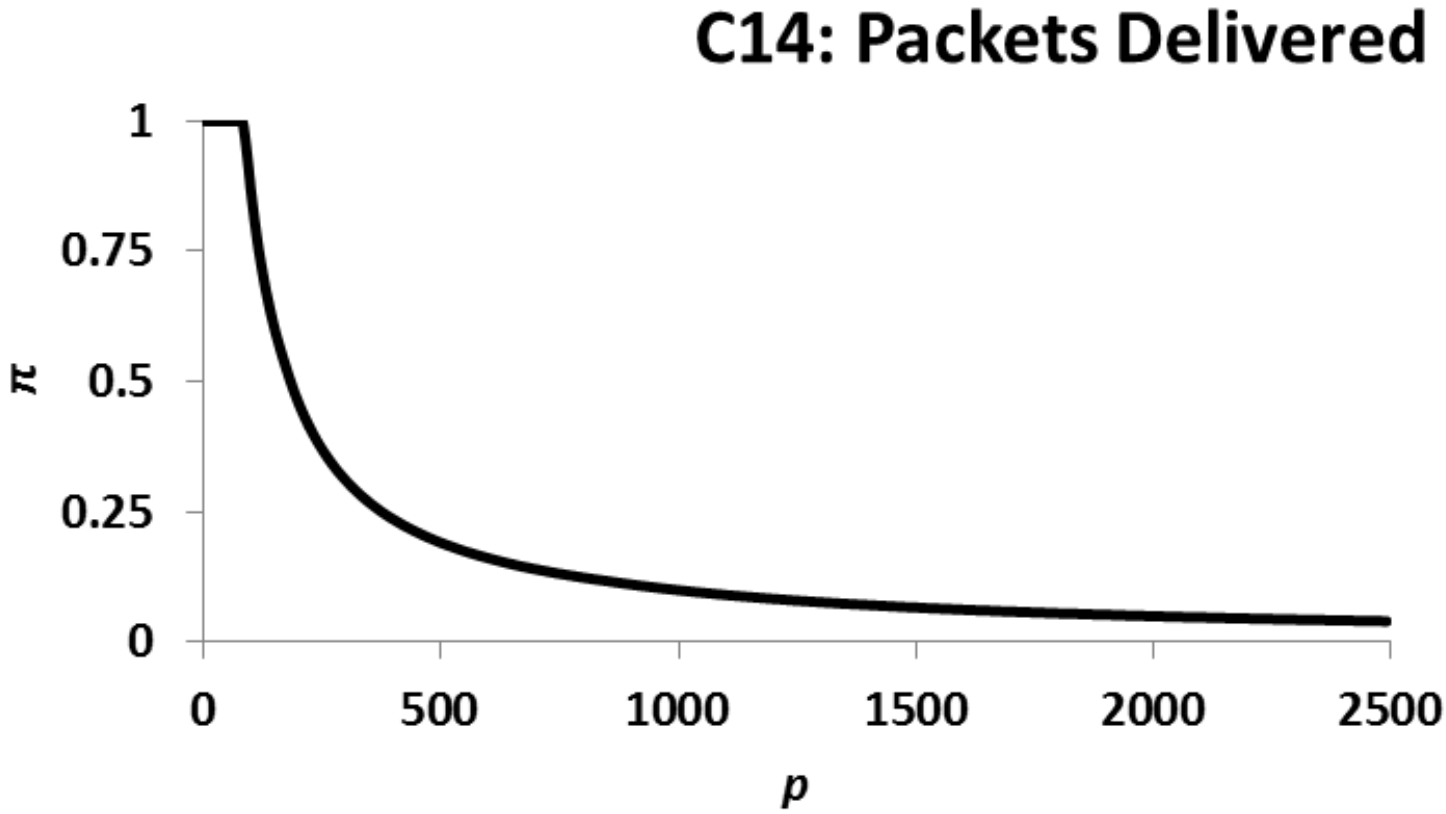

C3: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

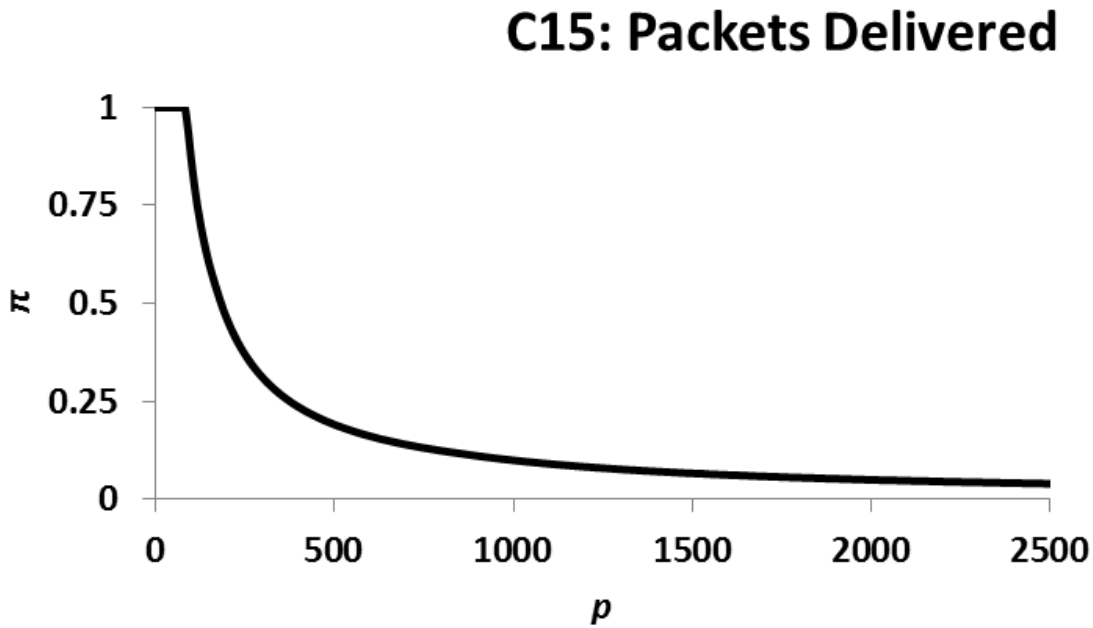

C6: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

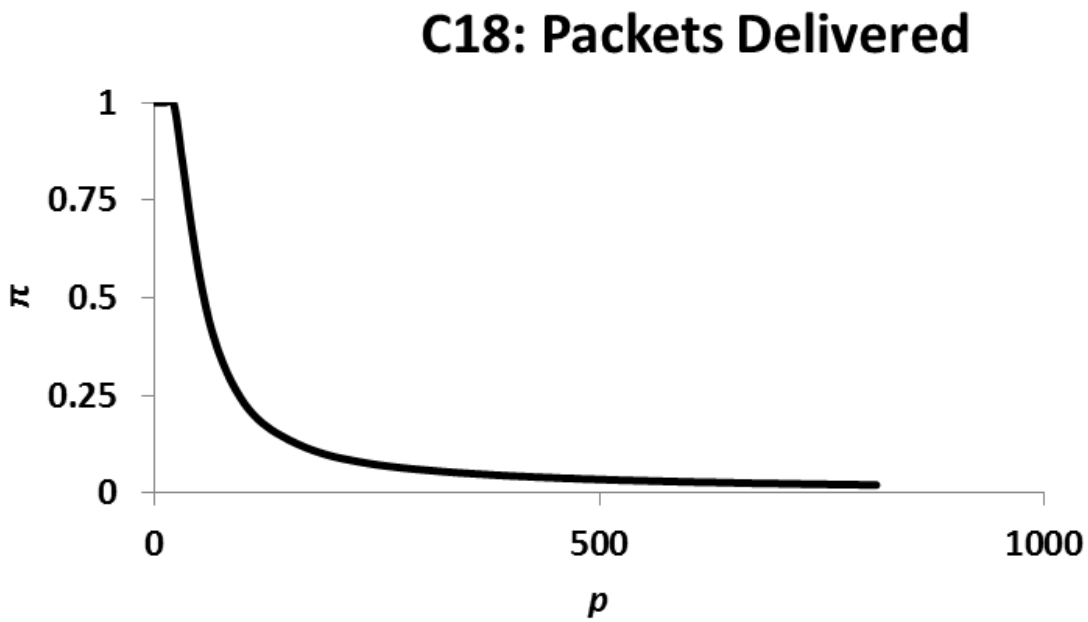

C7: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

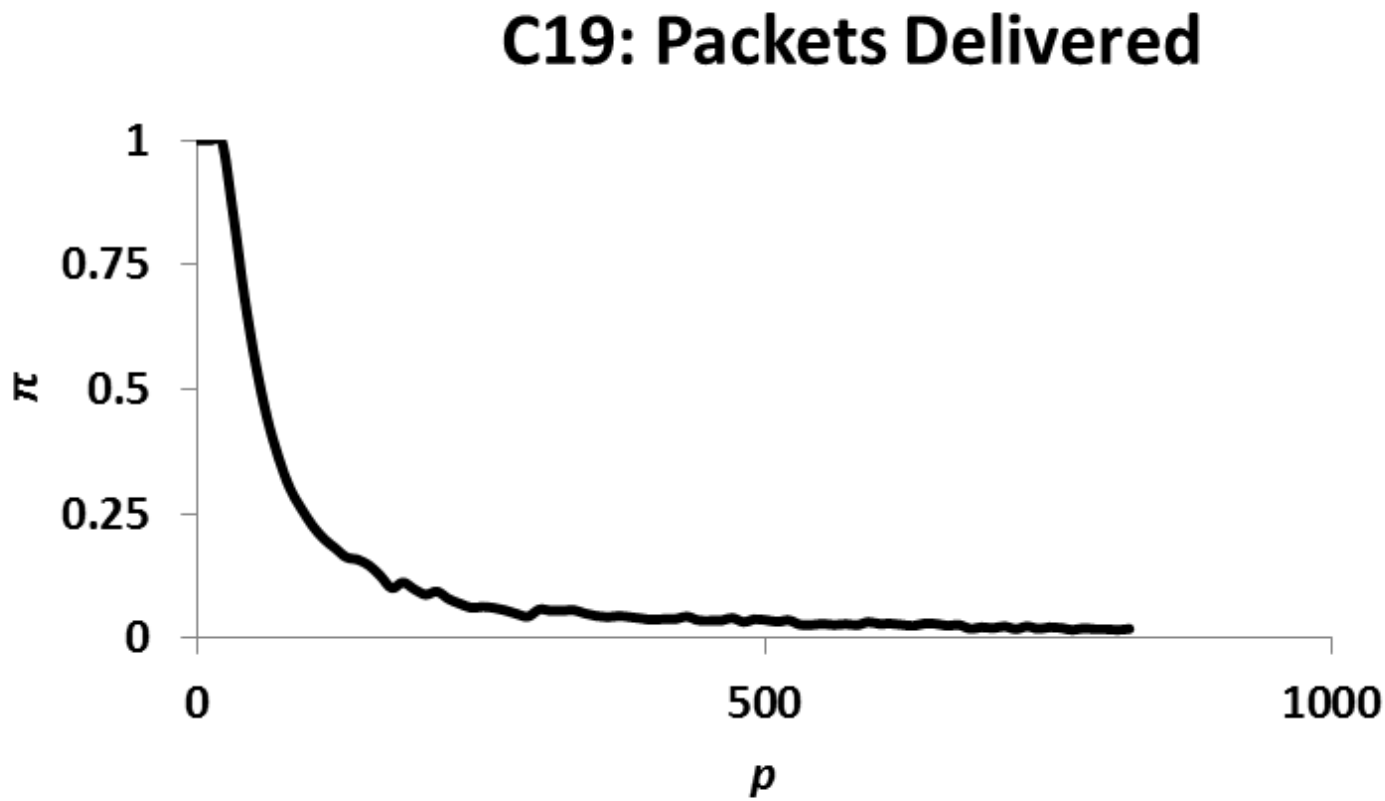

C10: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

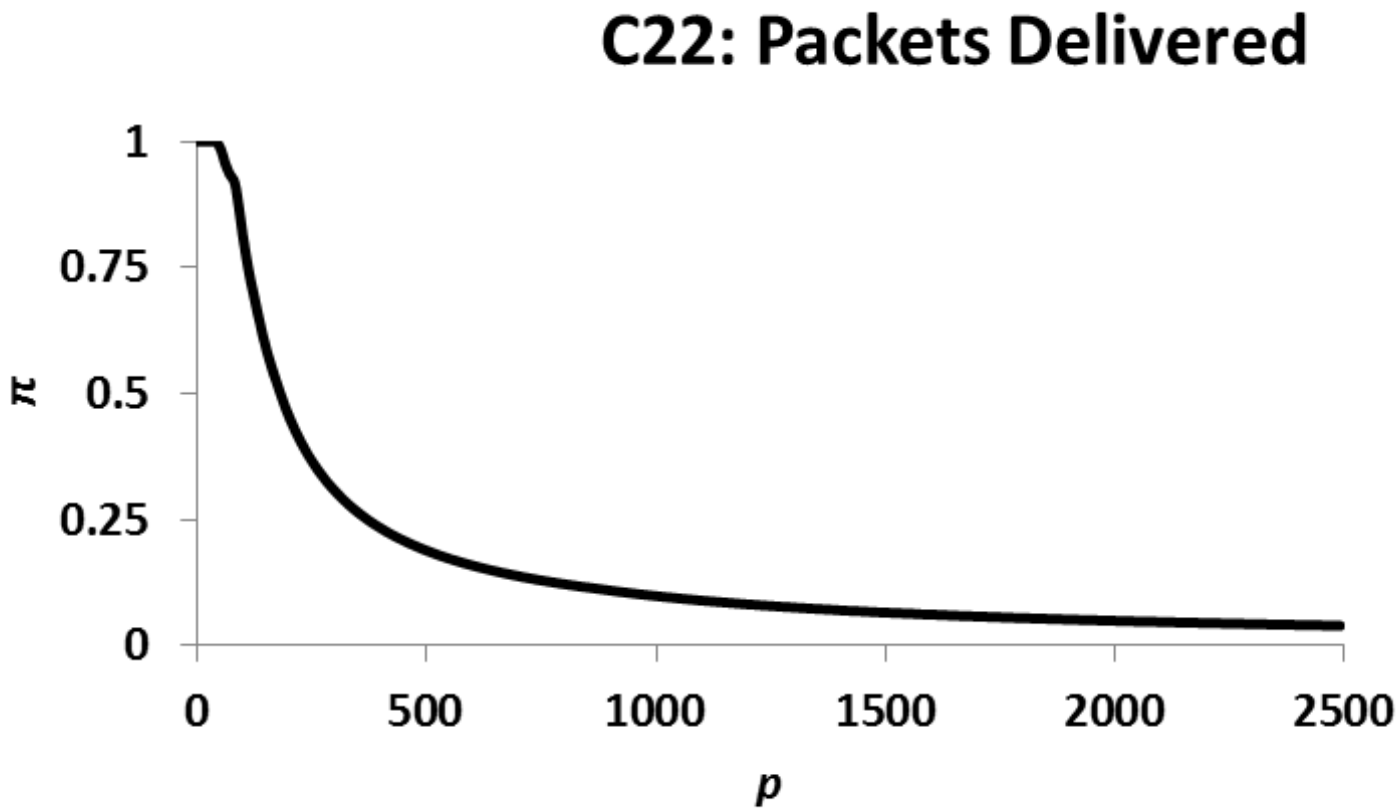

C11: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

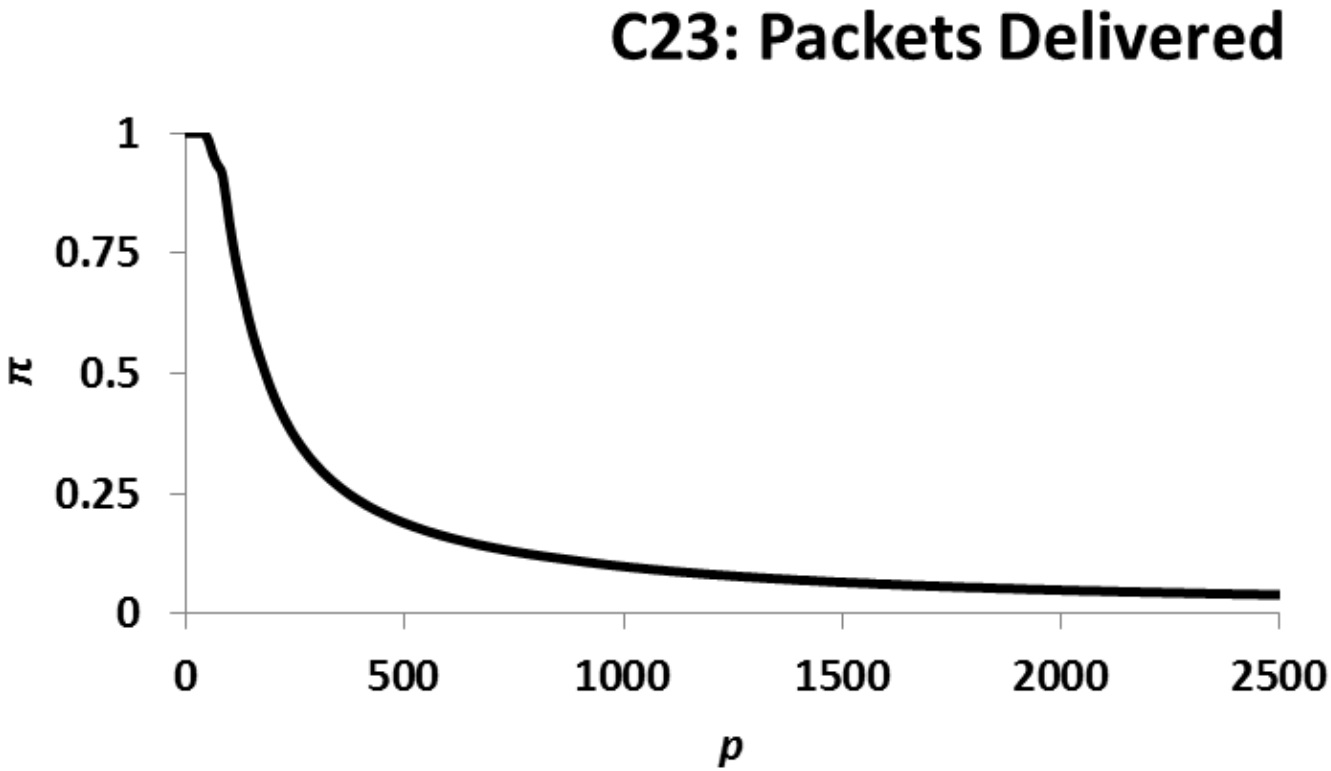

C14: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

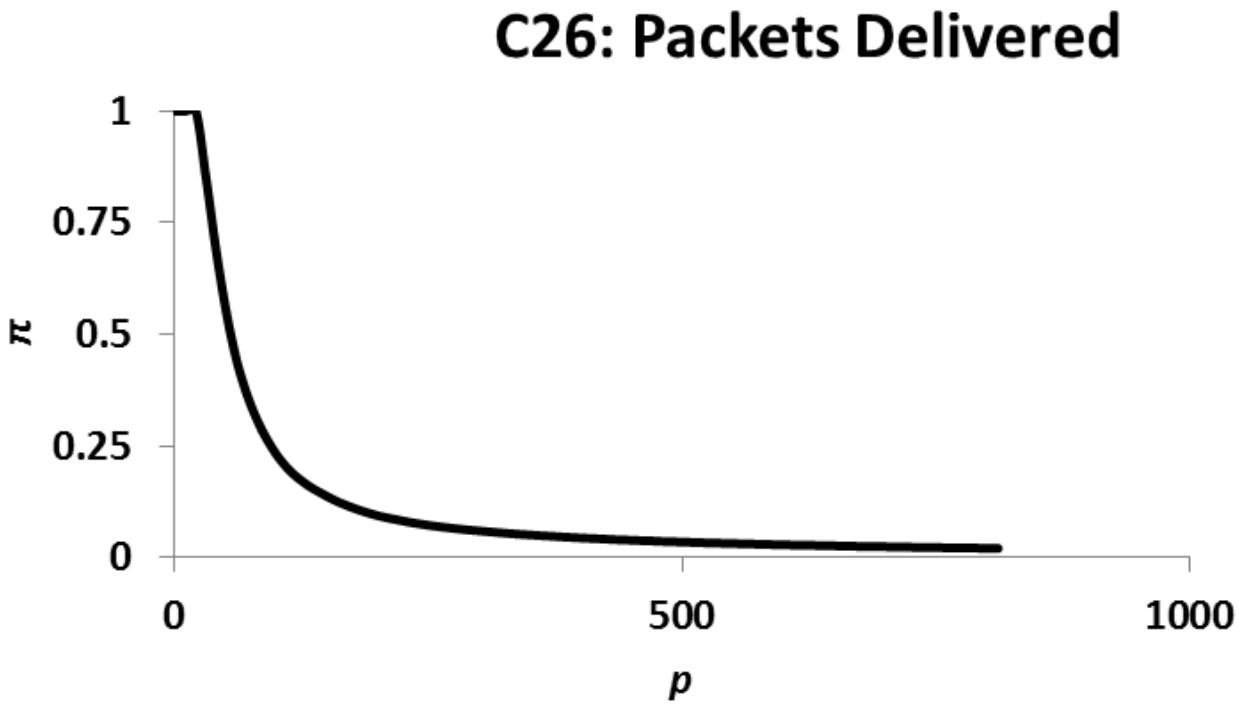

C15: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

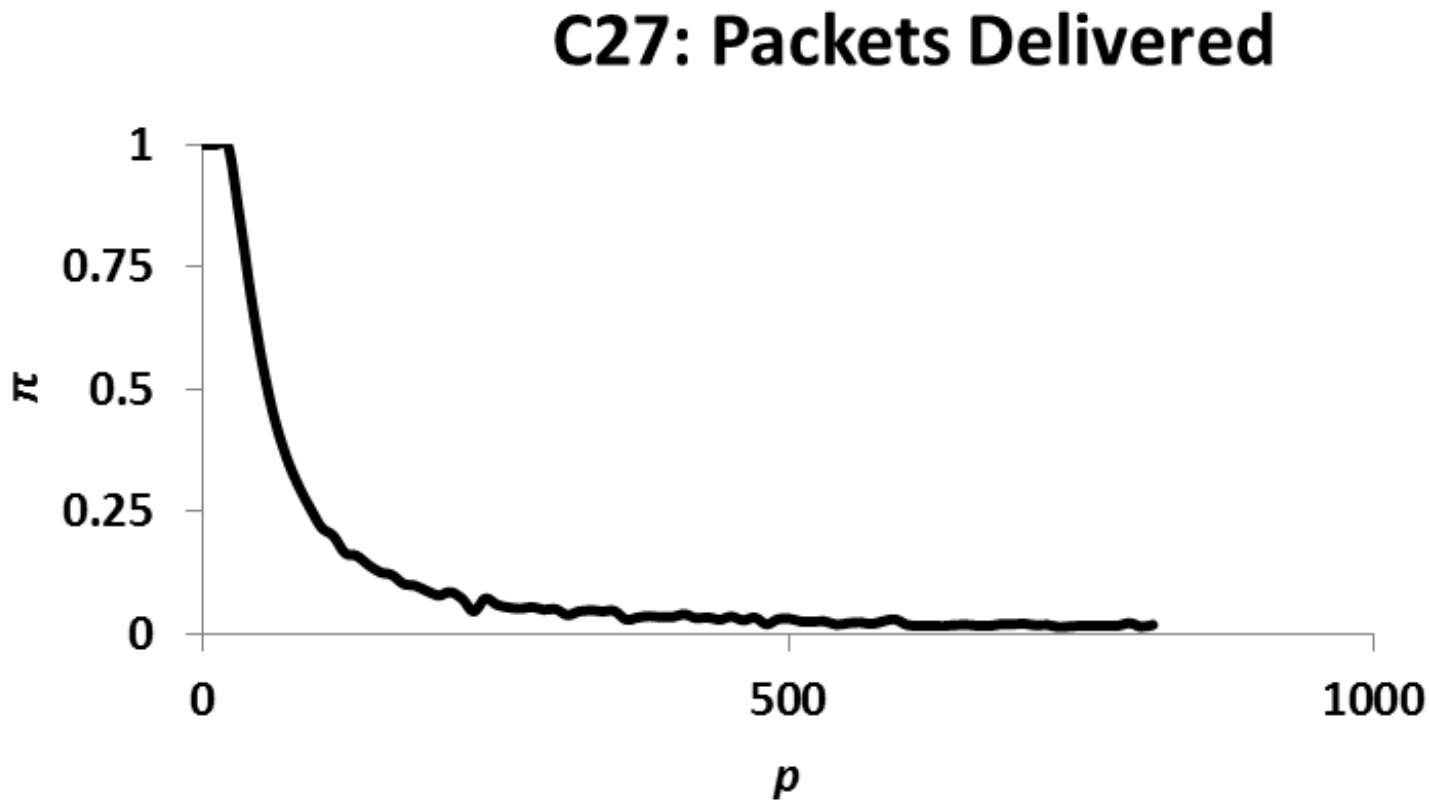

C18: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

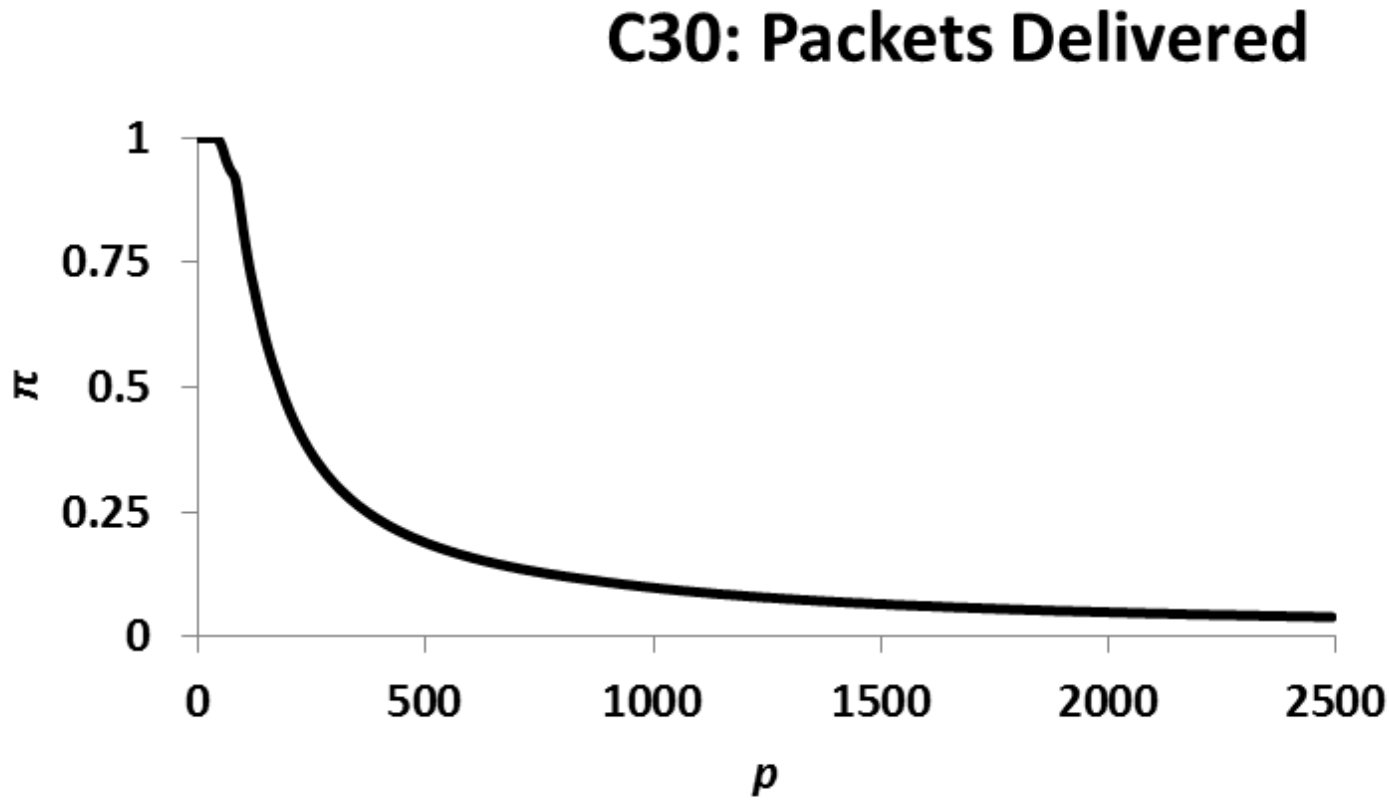

C19: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

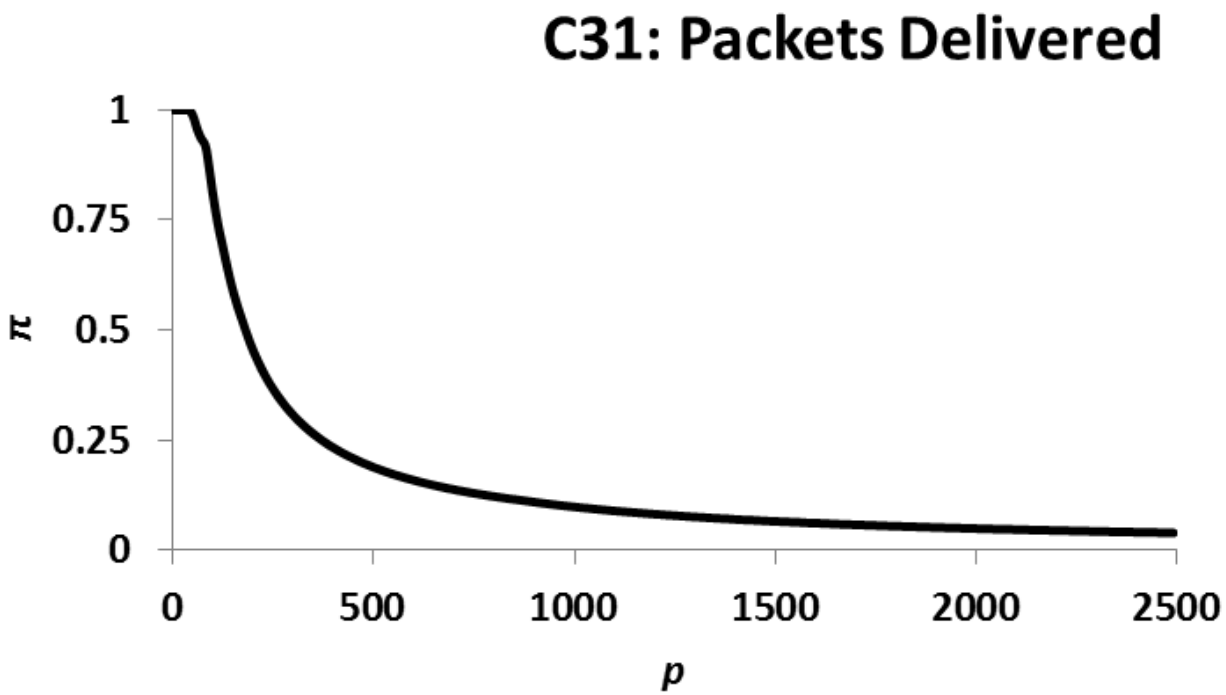

C22: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

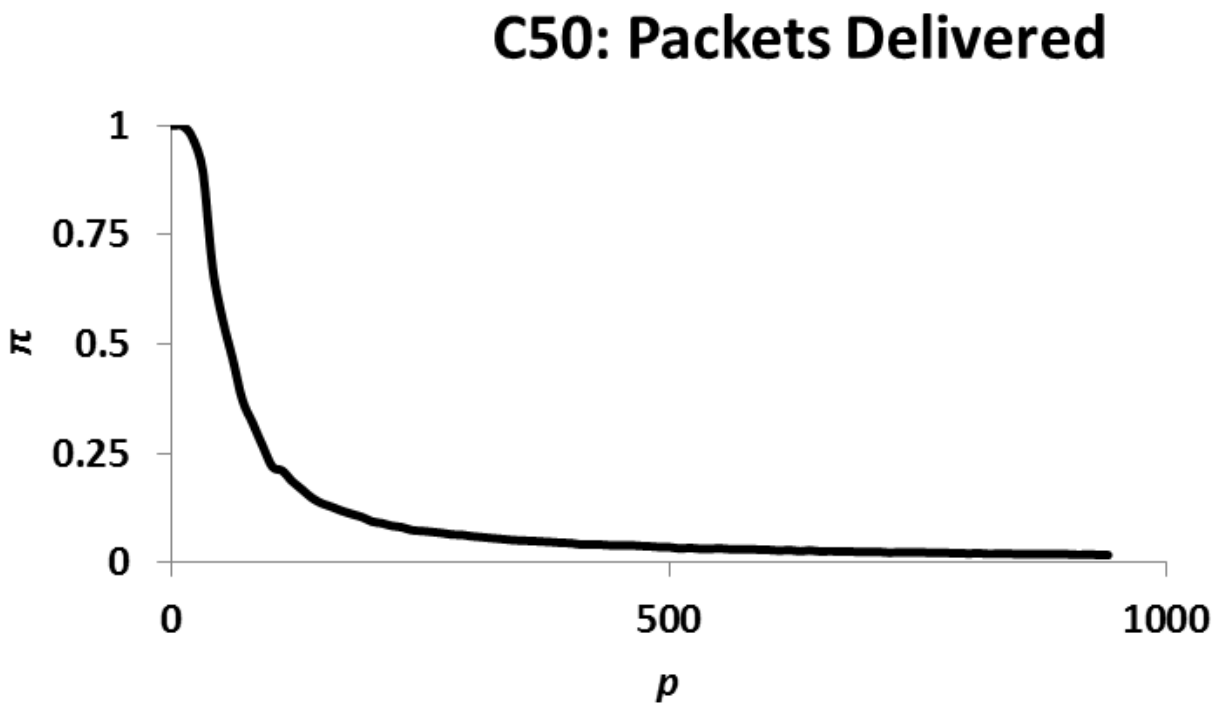

C23: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

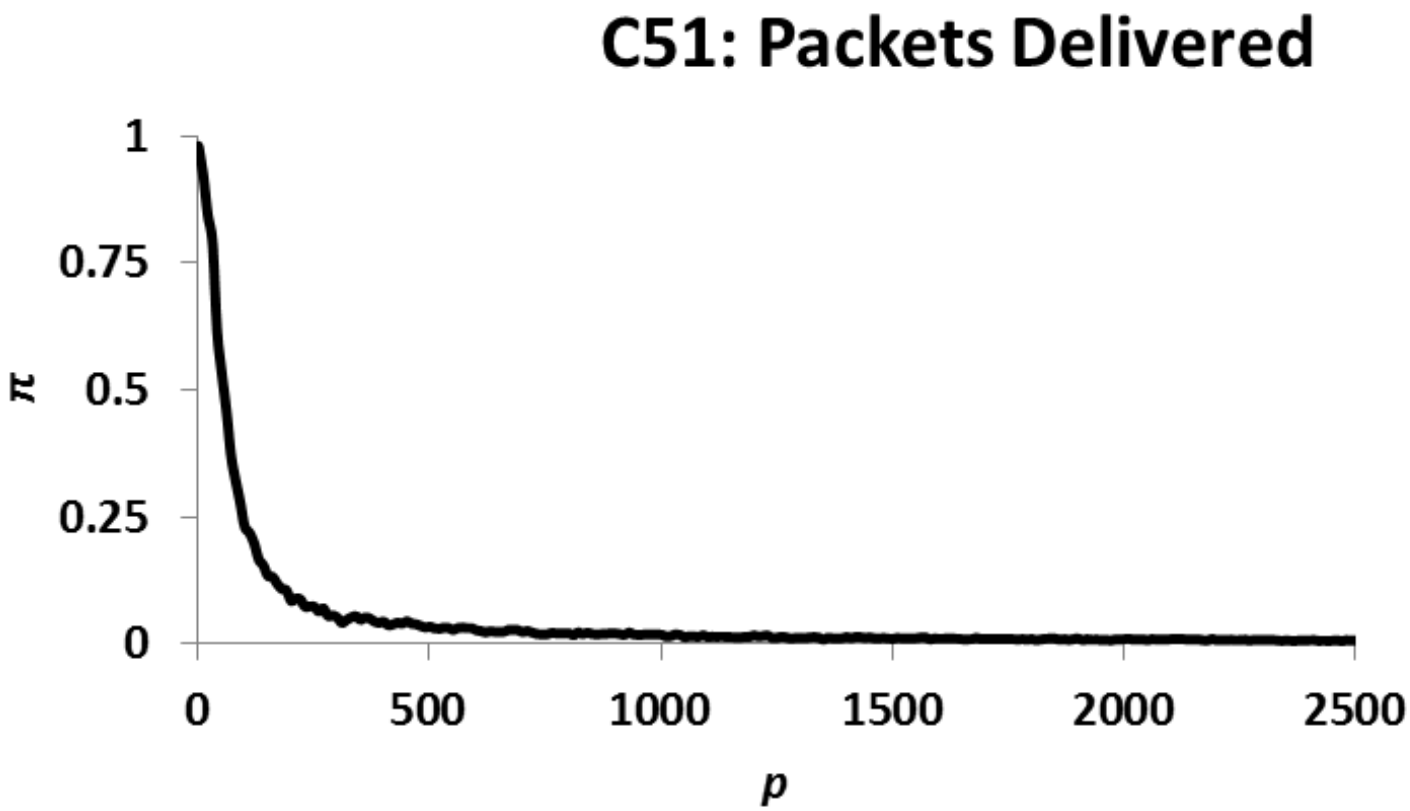

C26: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

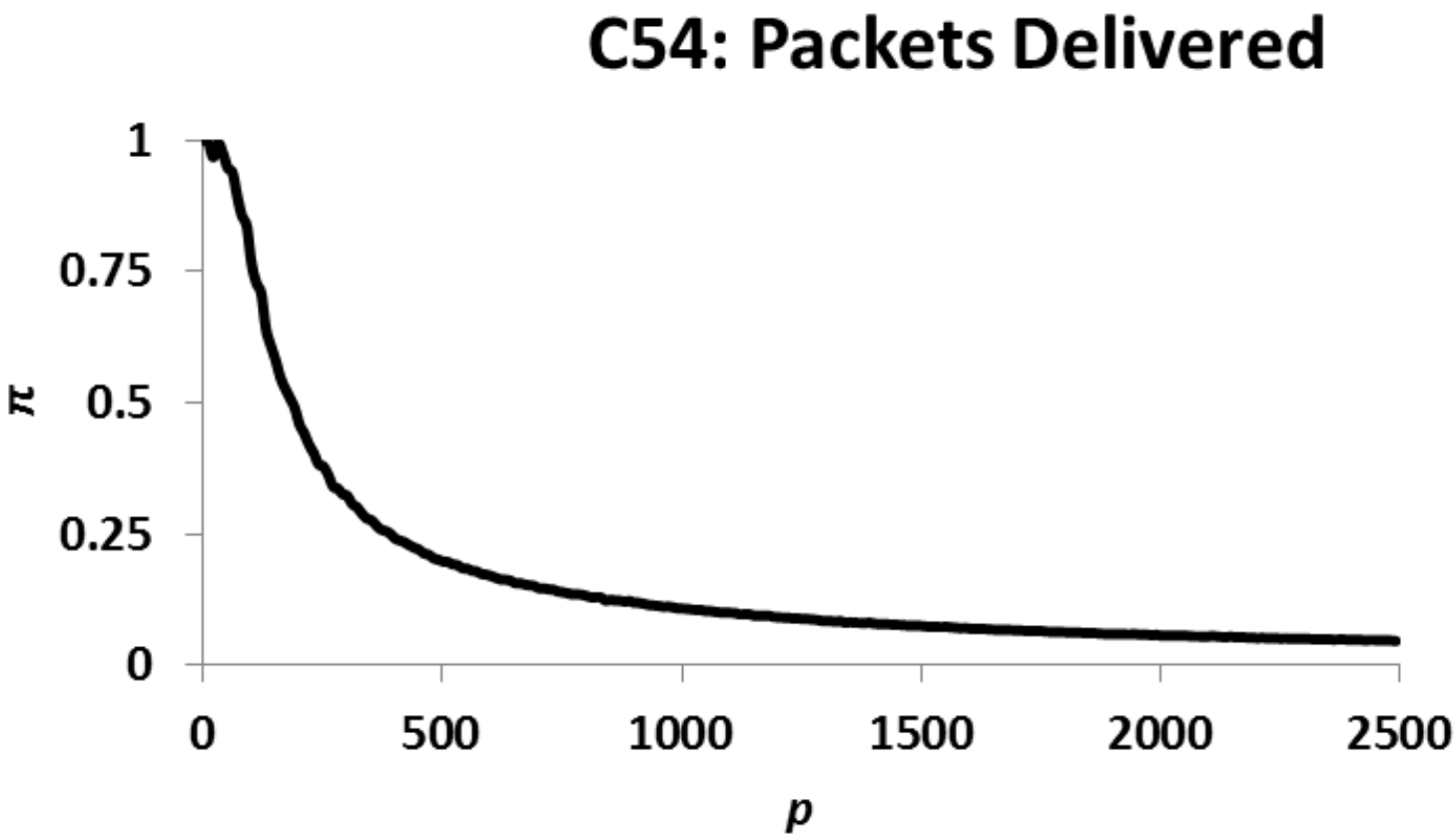

C27: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

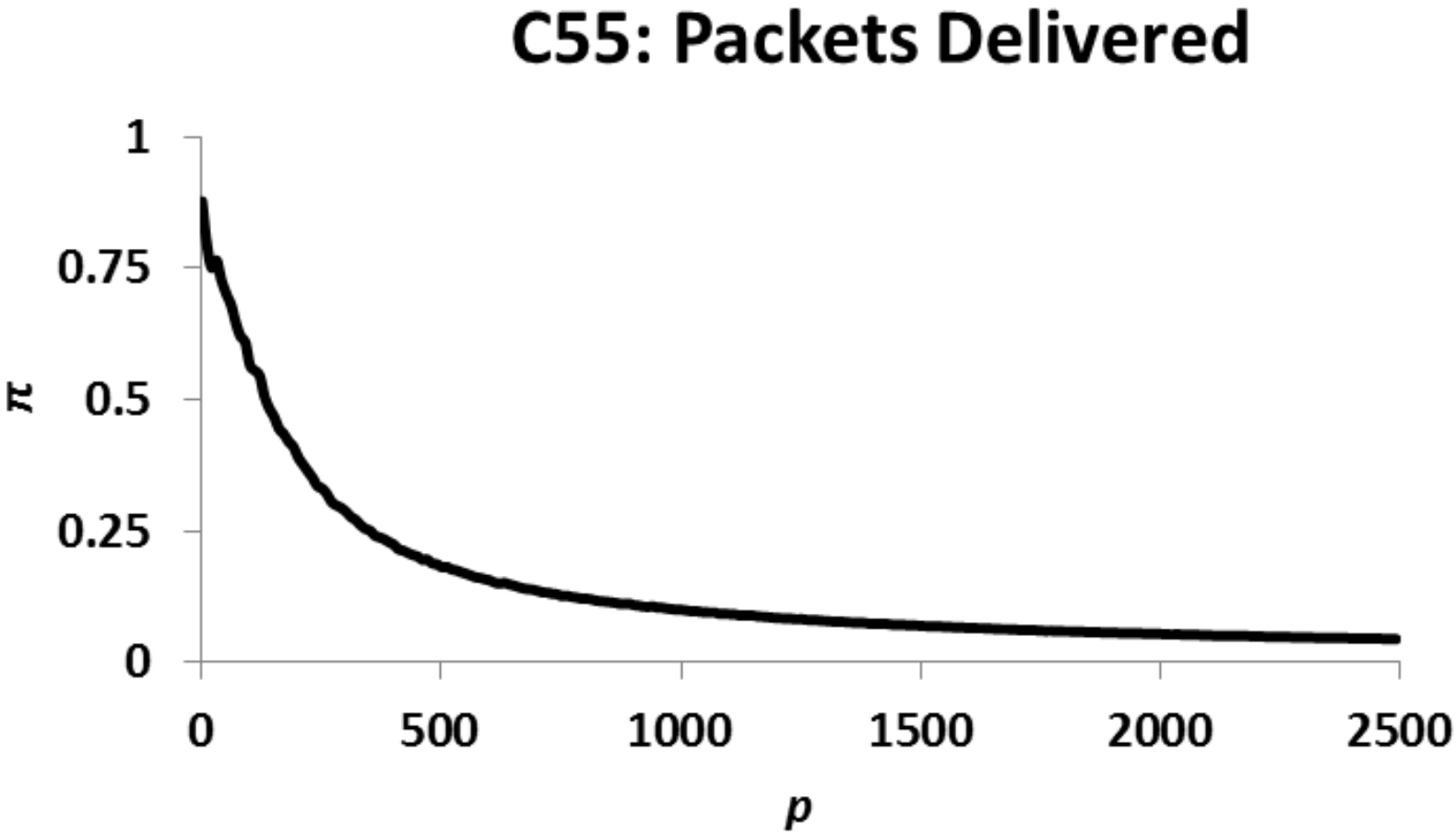

C30: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

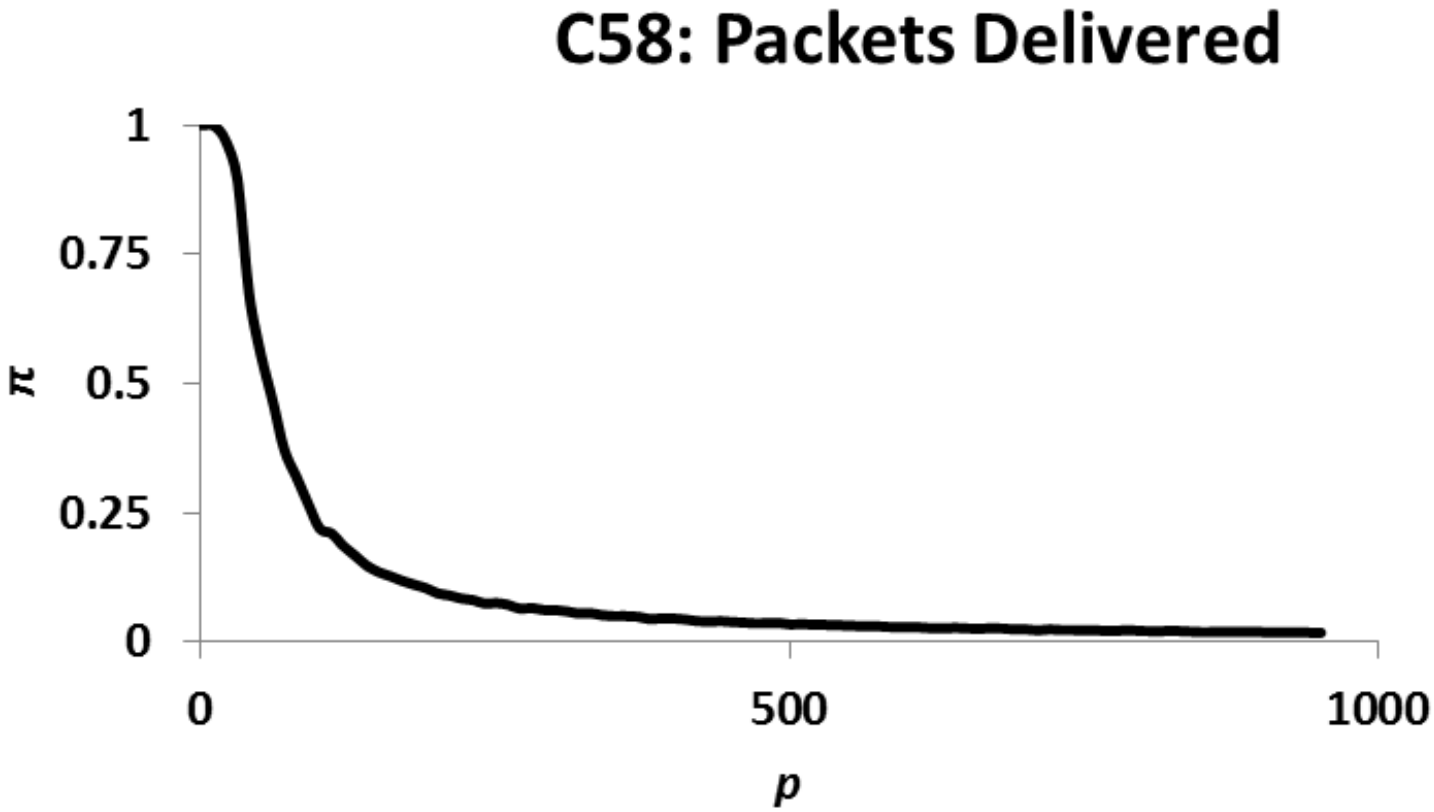

C31: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

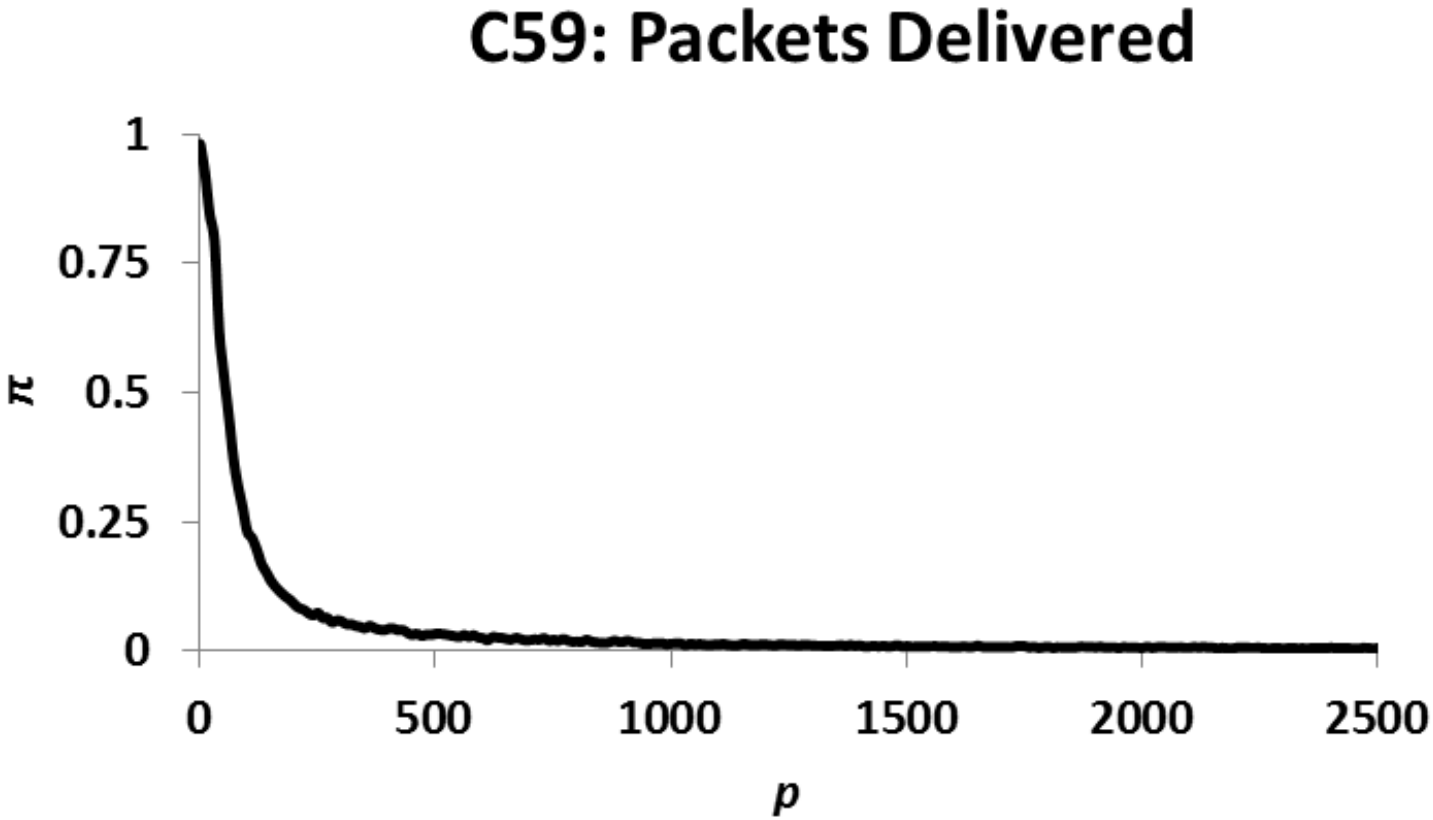

C50: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

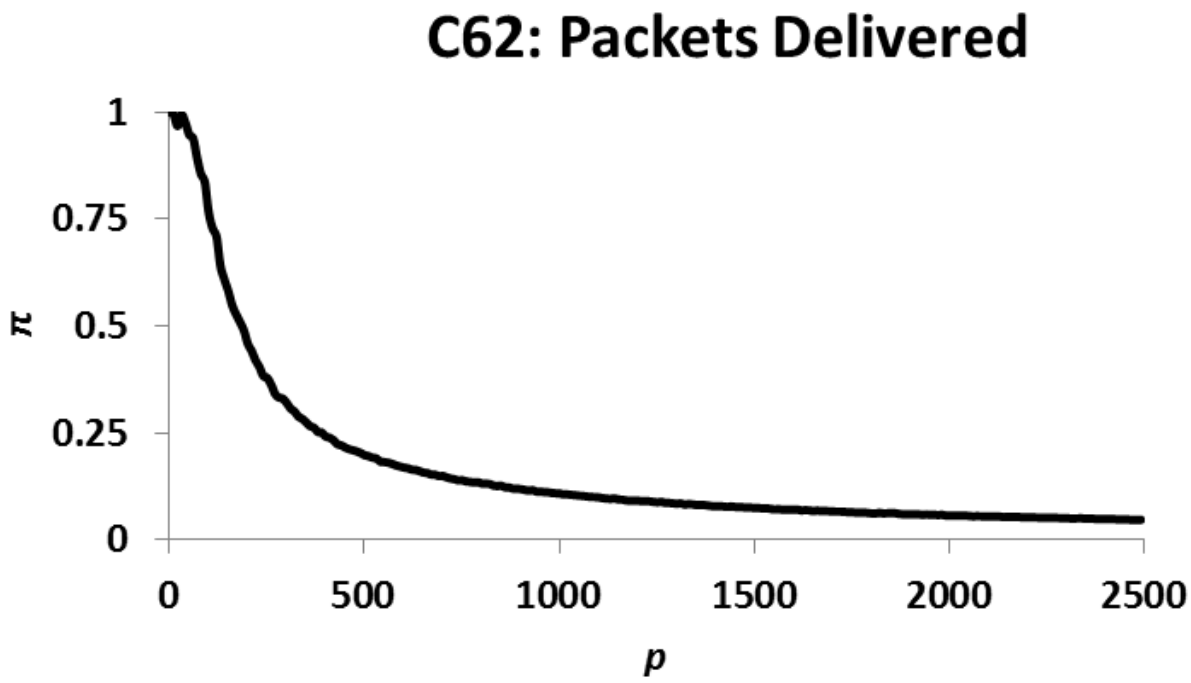

C51: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

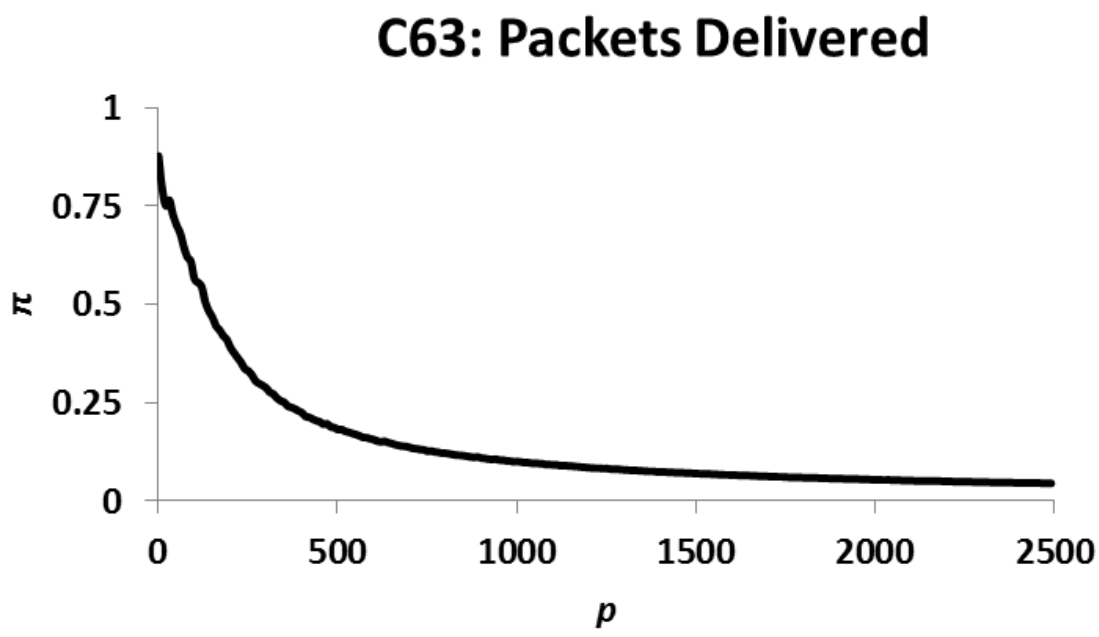

C54: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

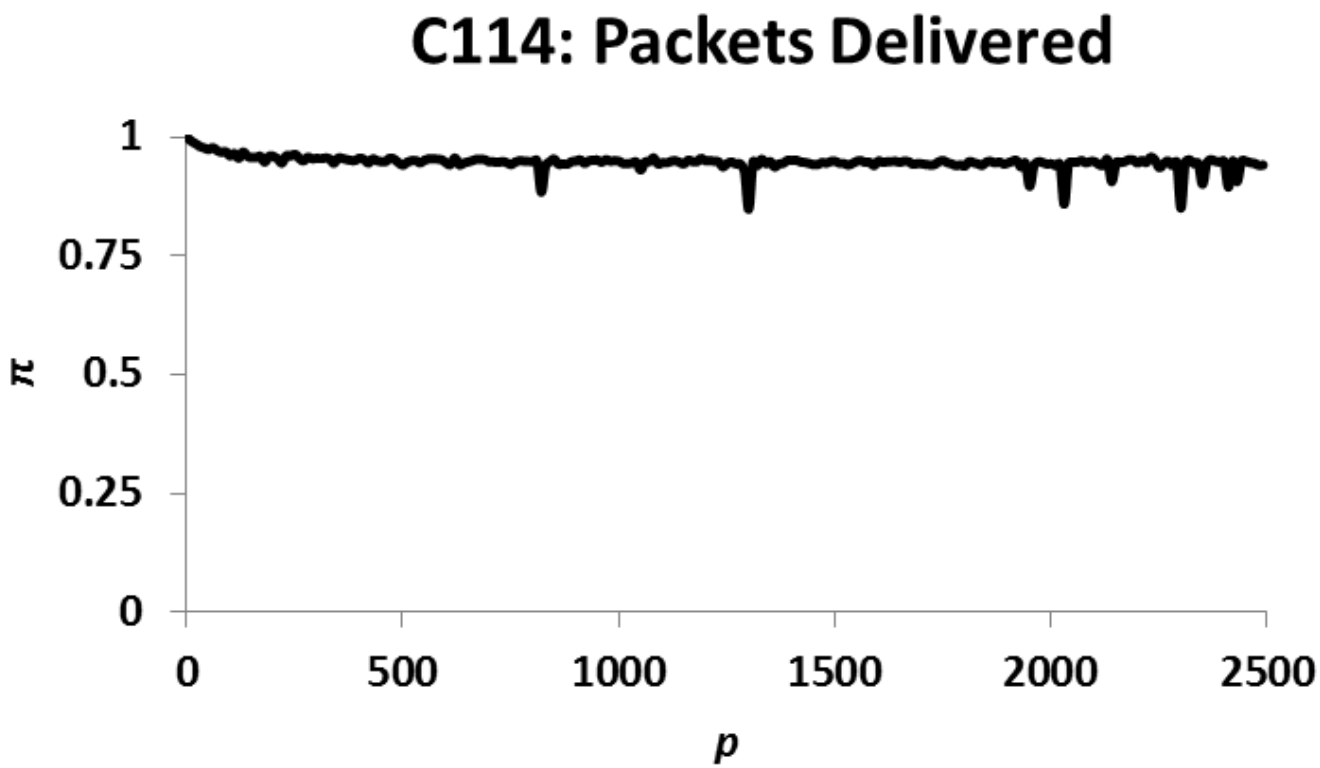

C55: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

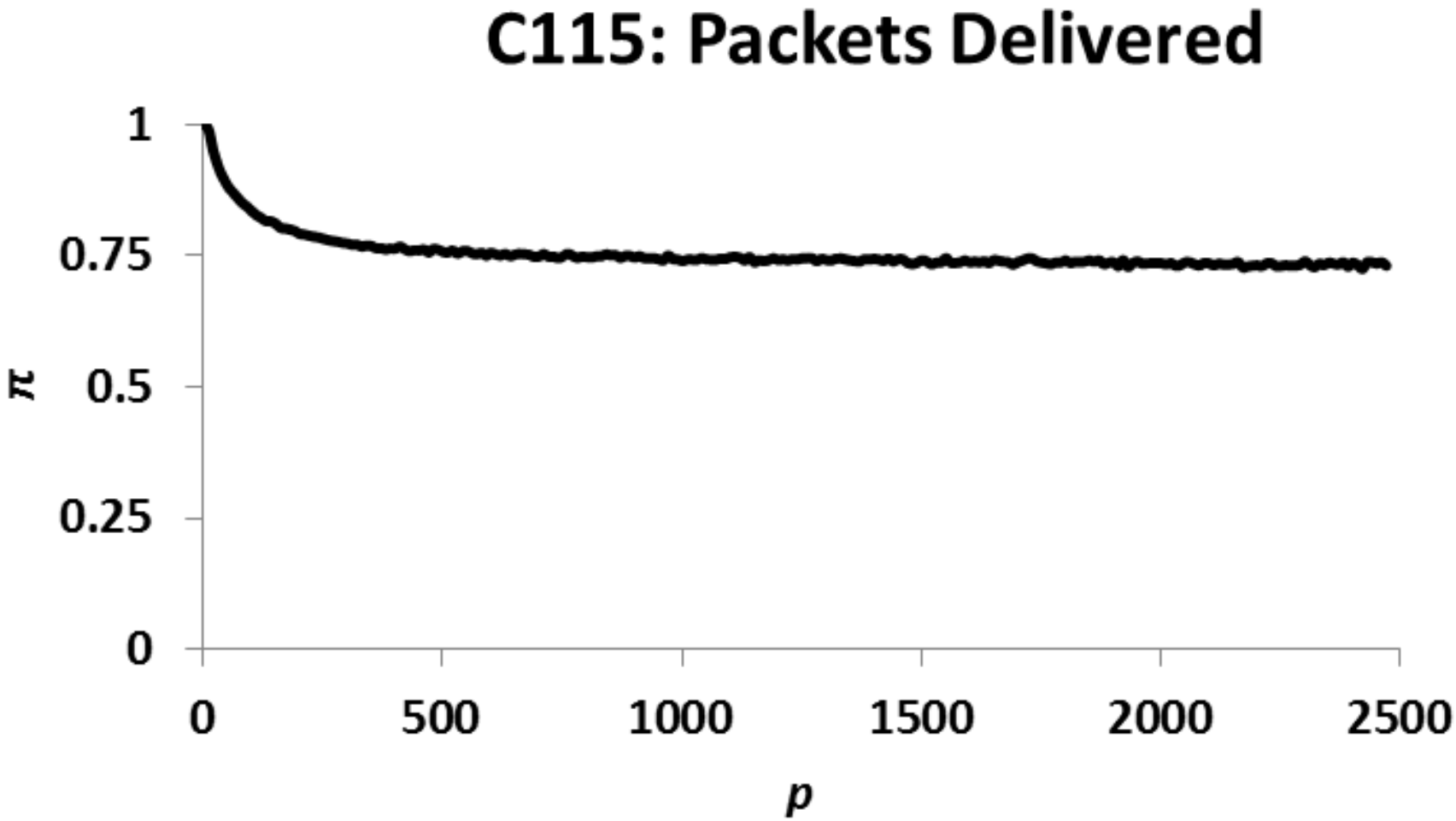

C58: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
p

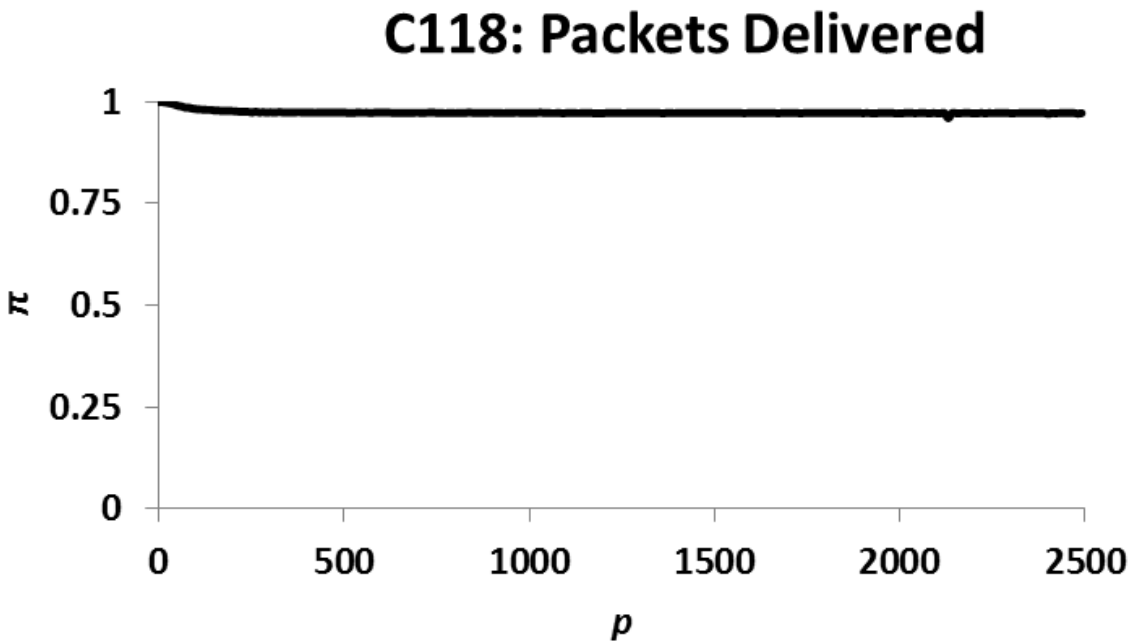

C59: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

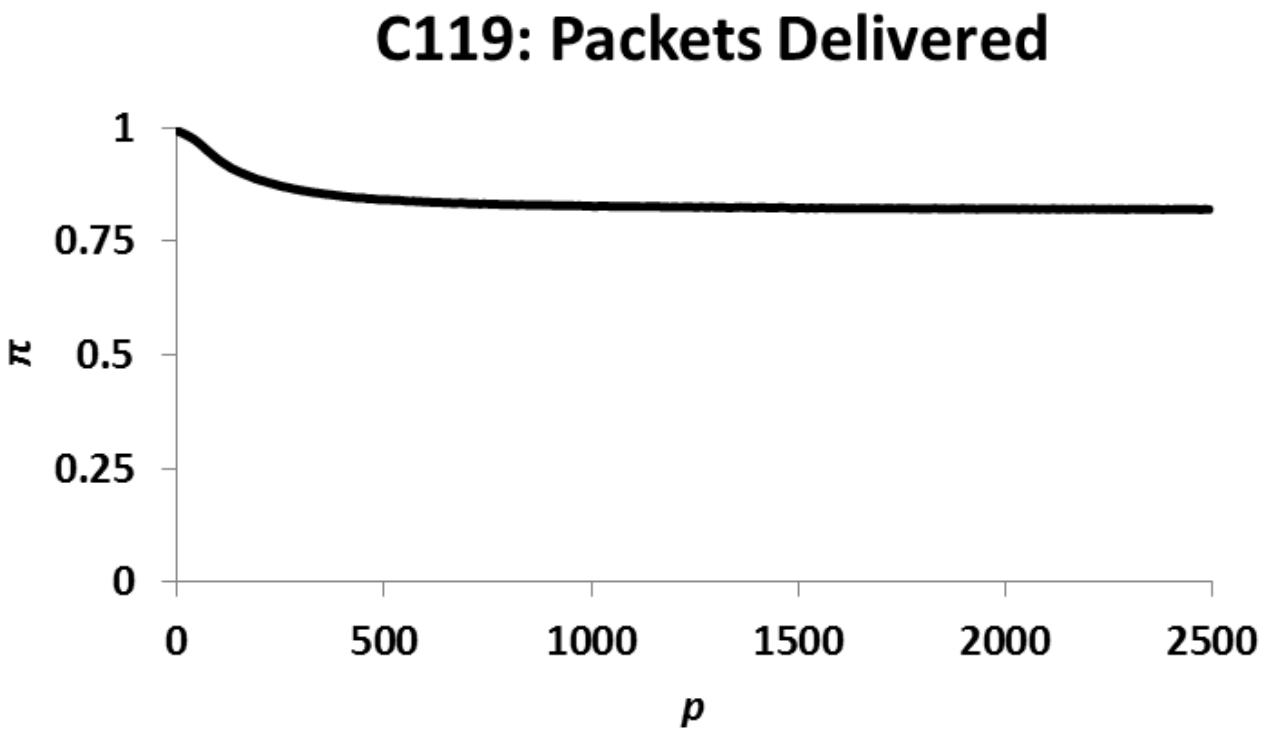

C62: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

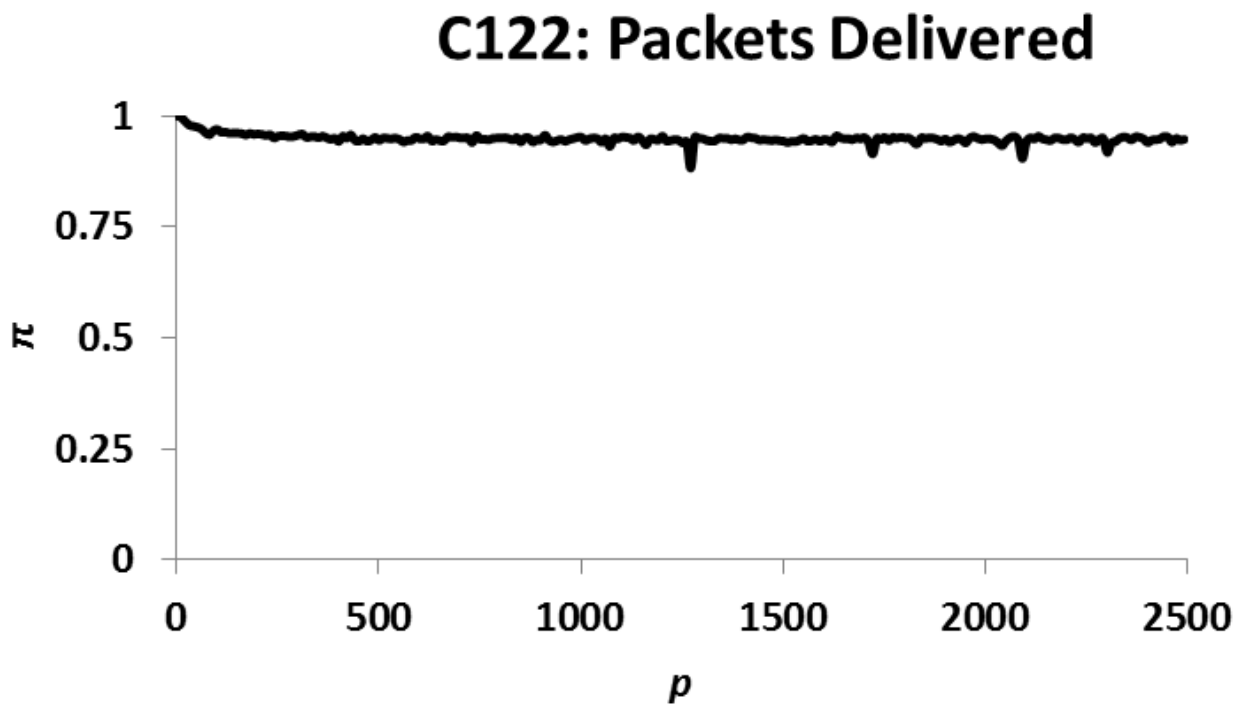

C63: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

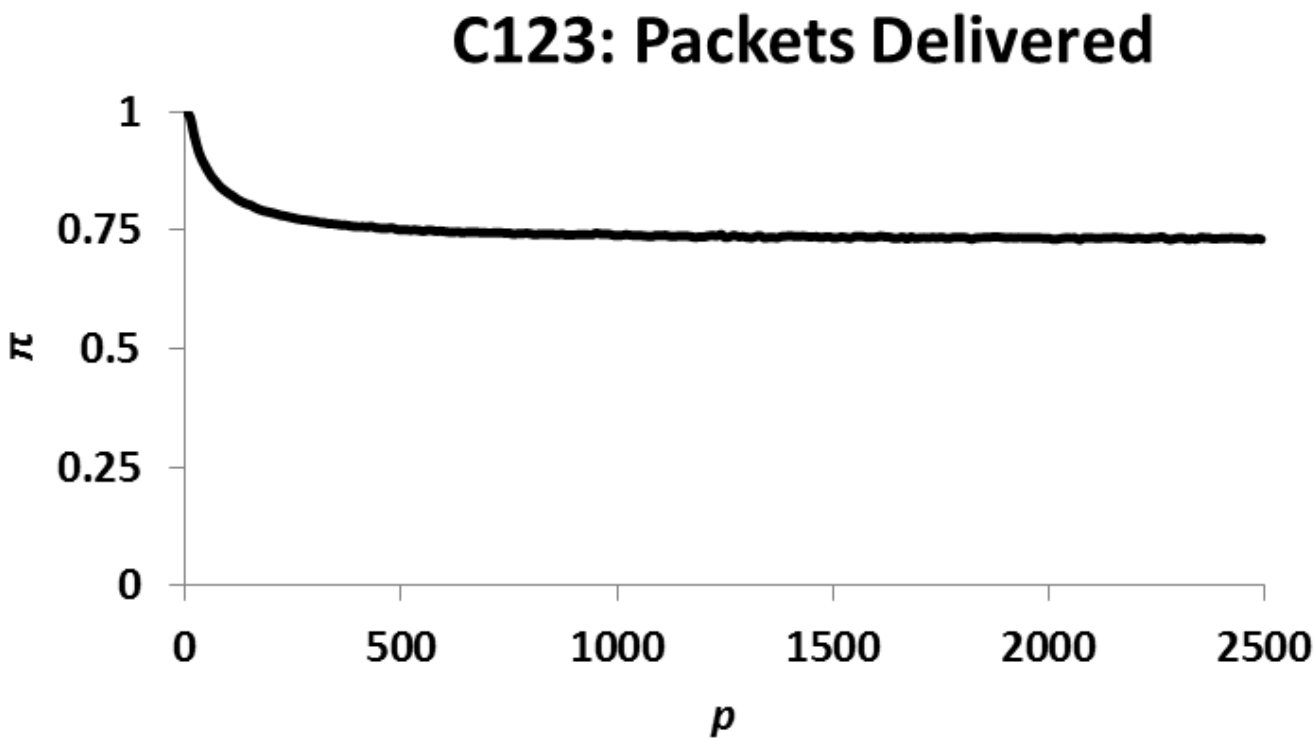

C114: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

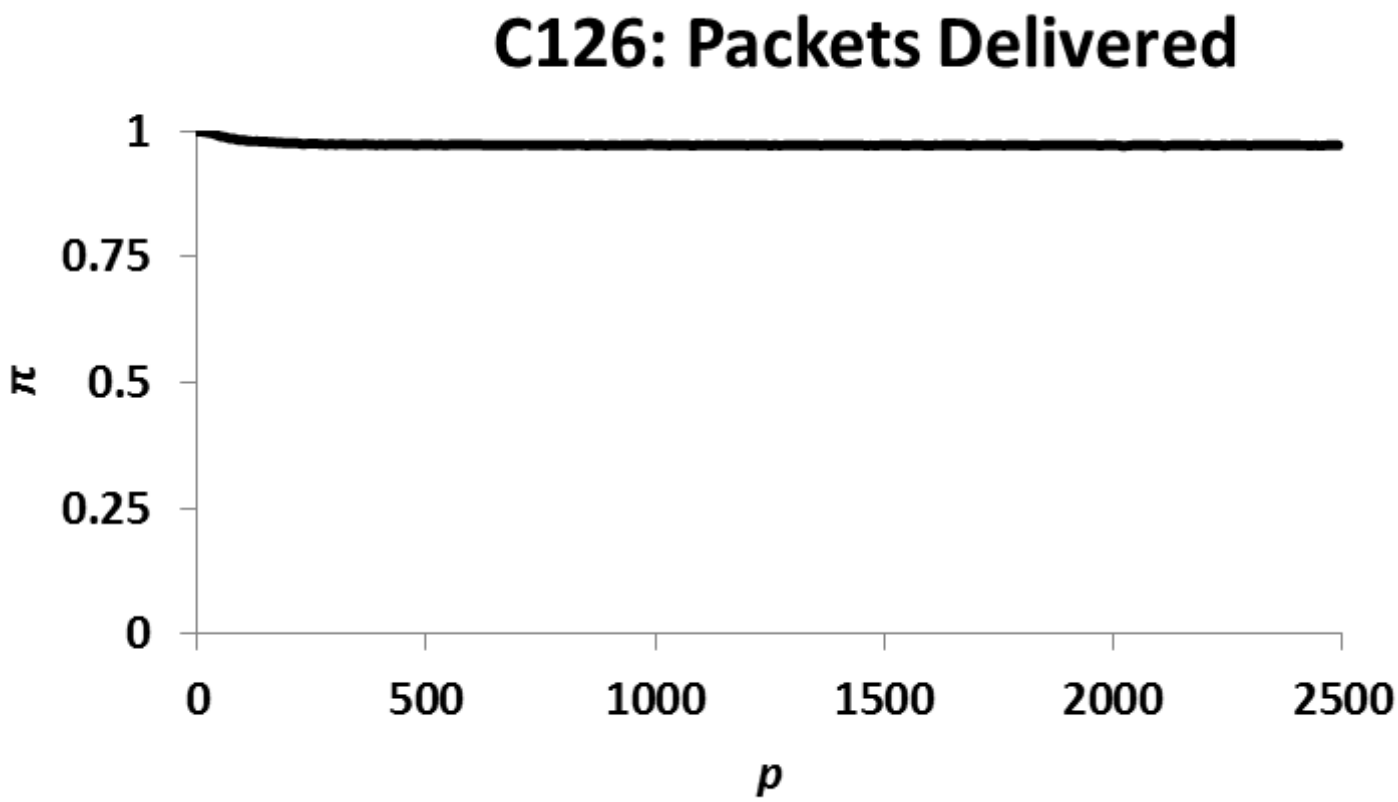

C115: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

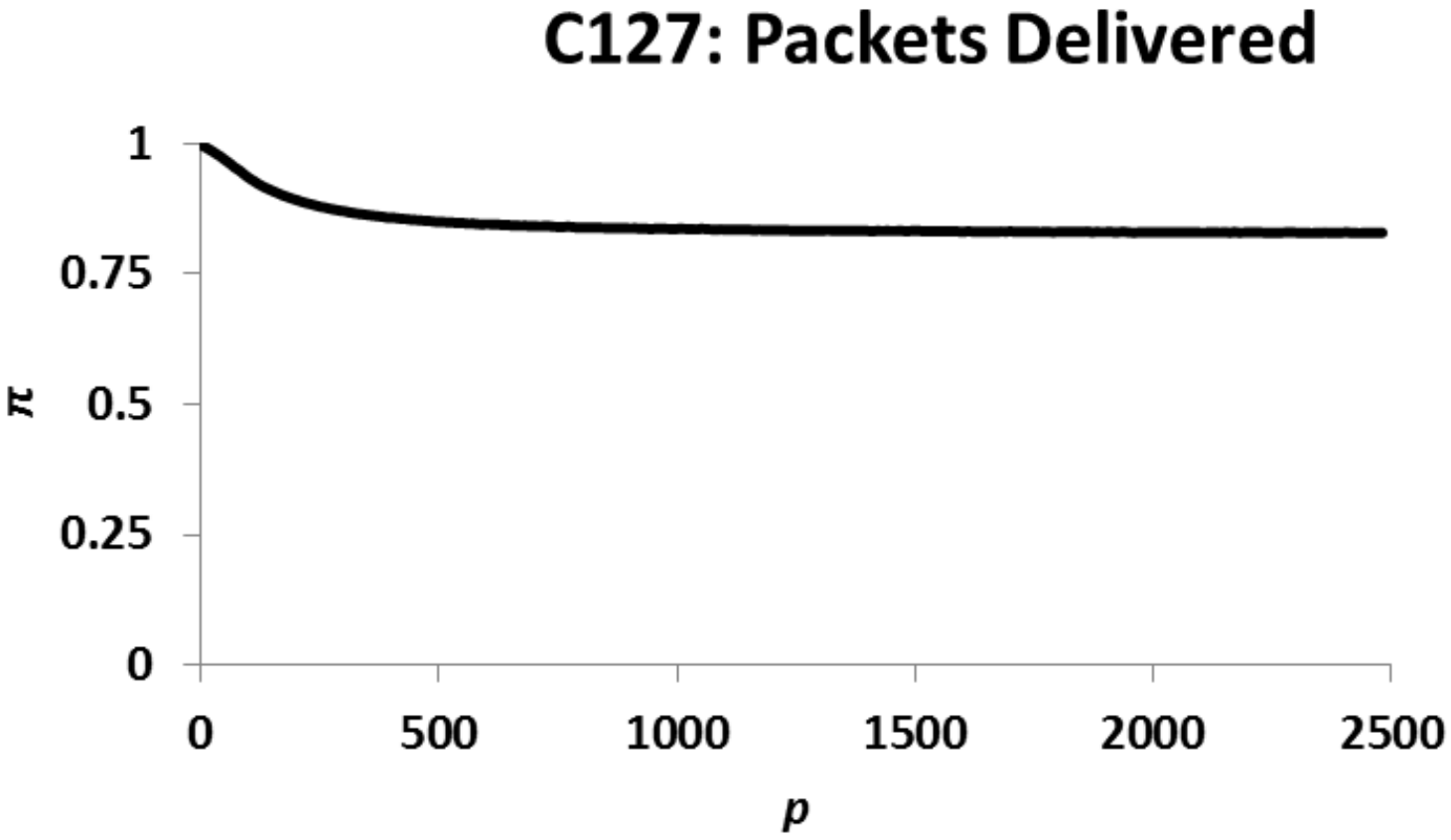

C118: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p


C119: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

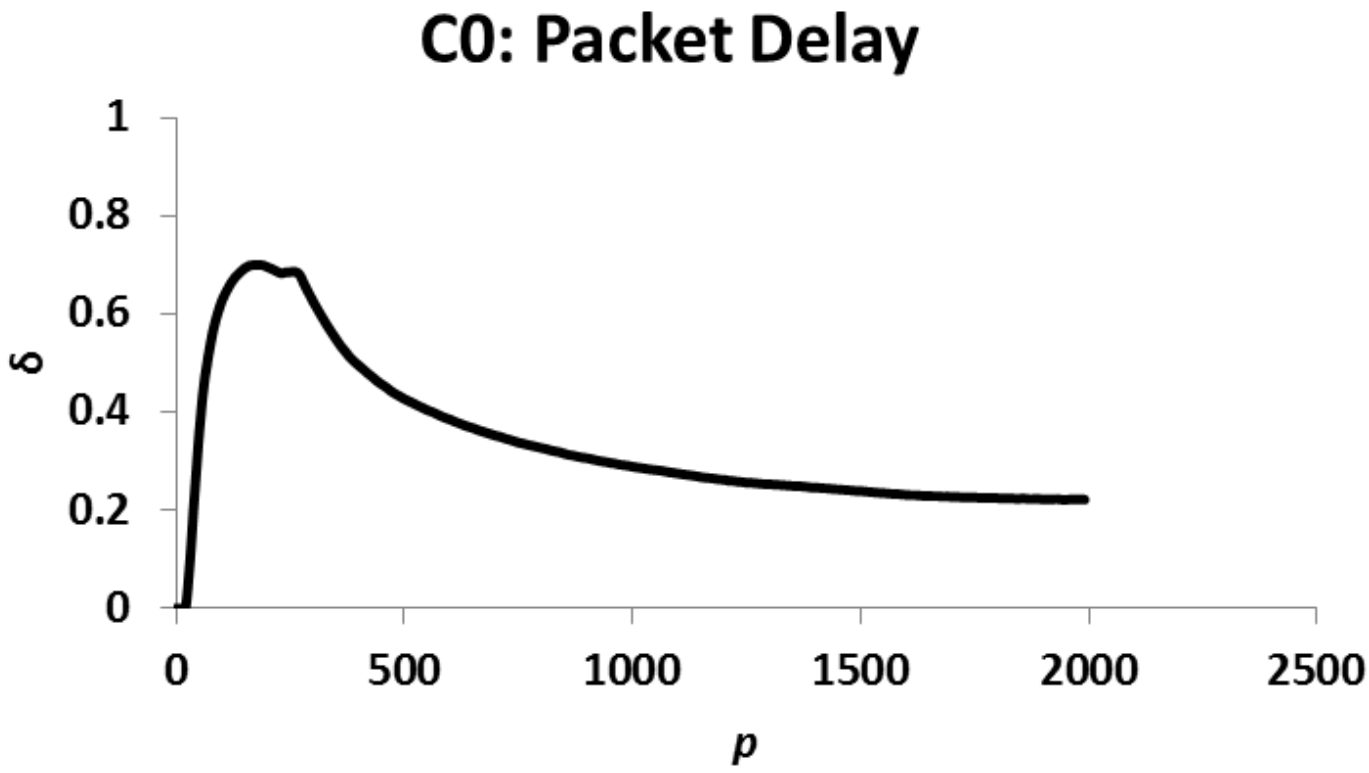

C122: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

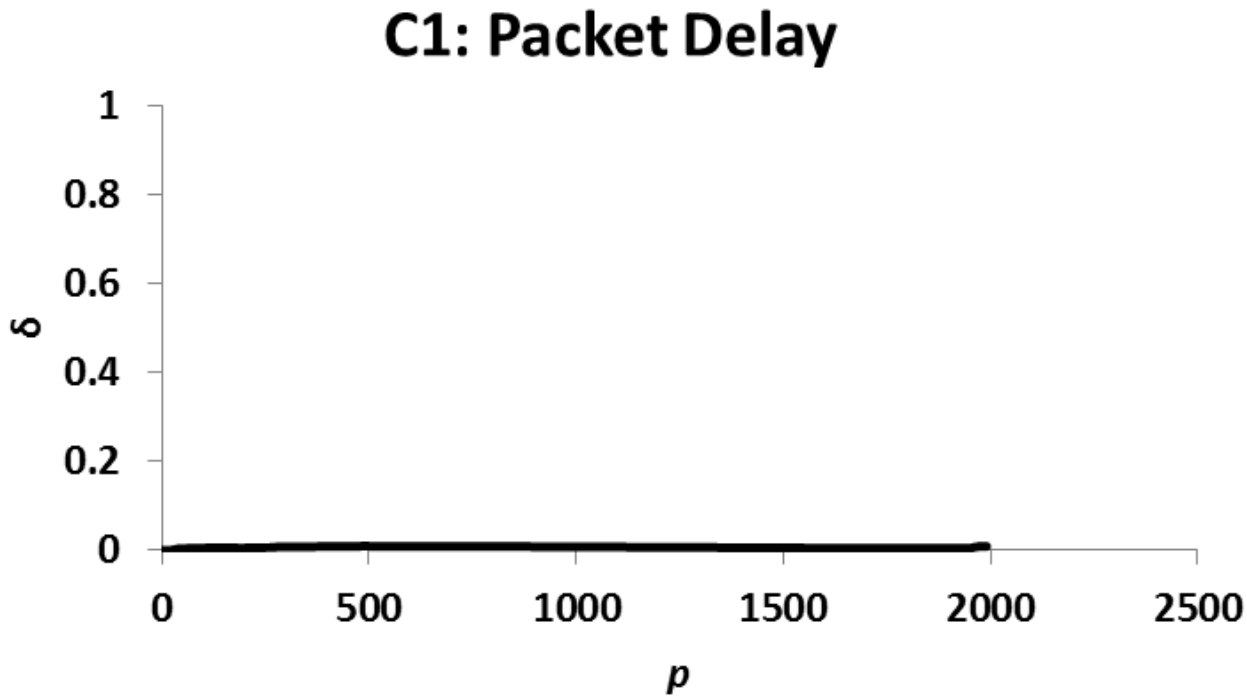

C123: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

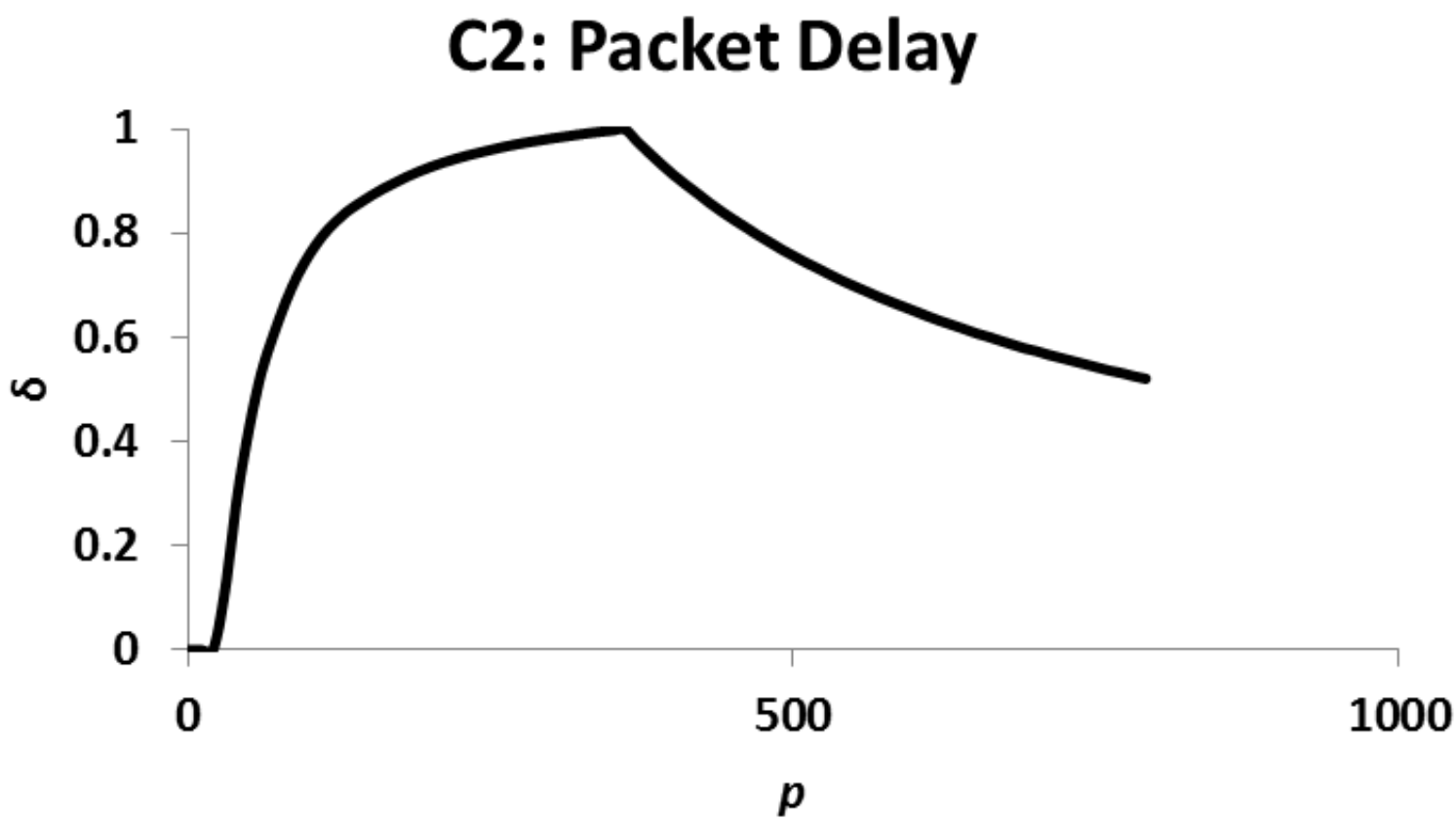

C126: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p


C127: Packets Delivered
1
0.75
0.5
0.25
0
π
0
500
1000
1500
2000
2500
p

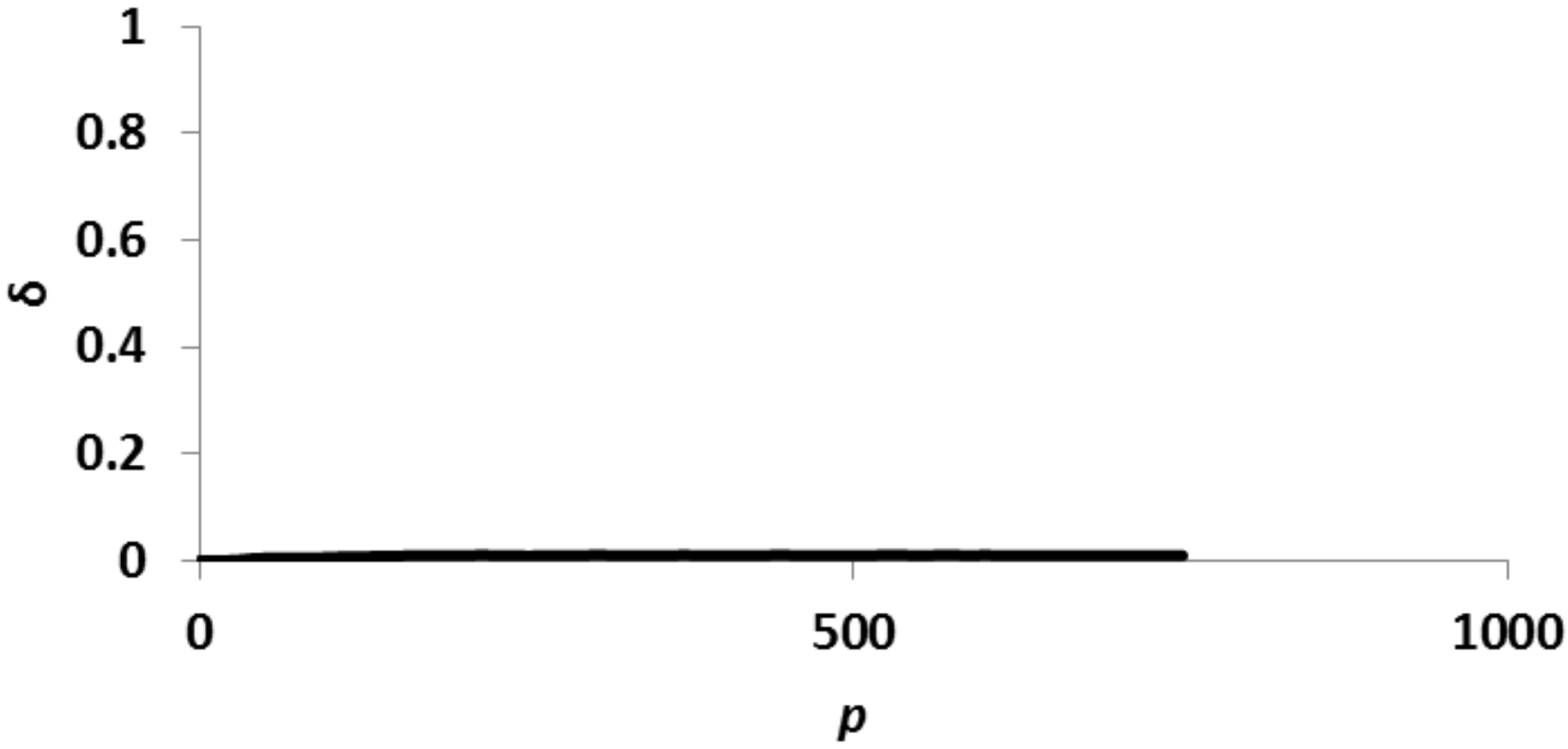
Graphs for Packet Delivery Efficiency (δ) Figure 24
(Dabrowski & Mills NIST)

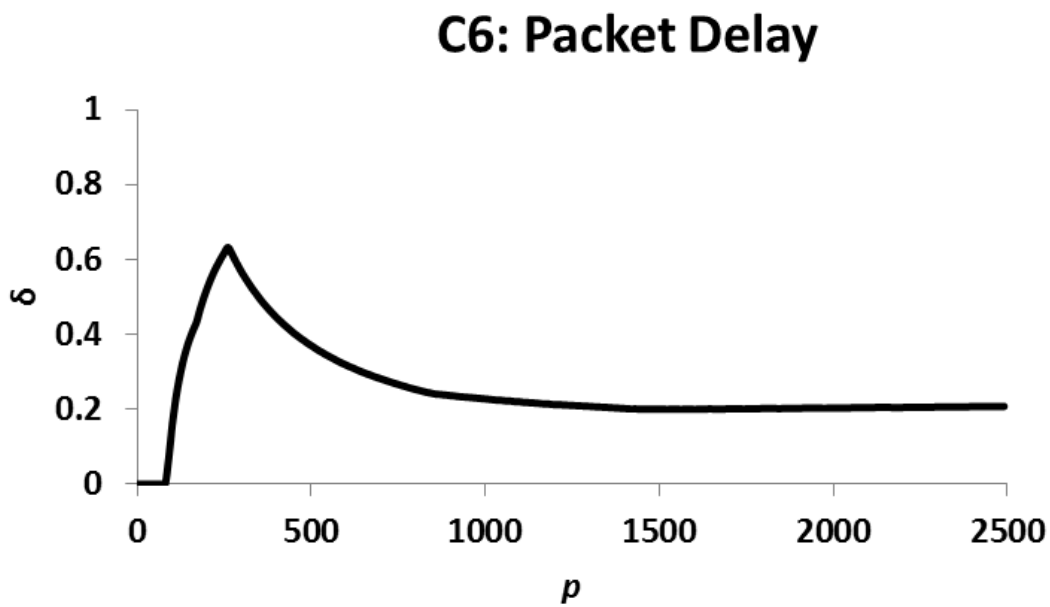

C0: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

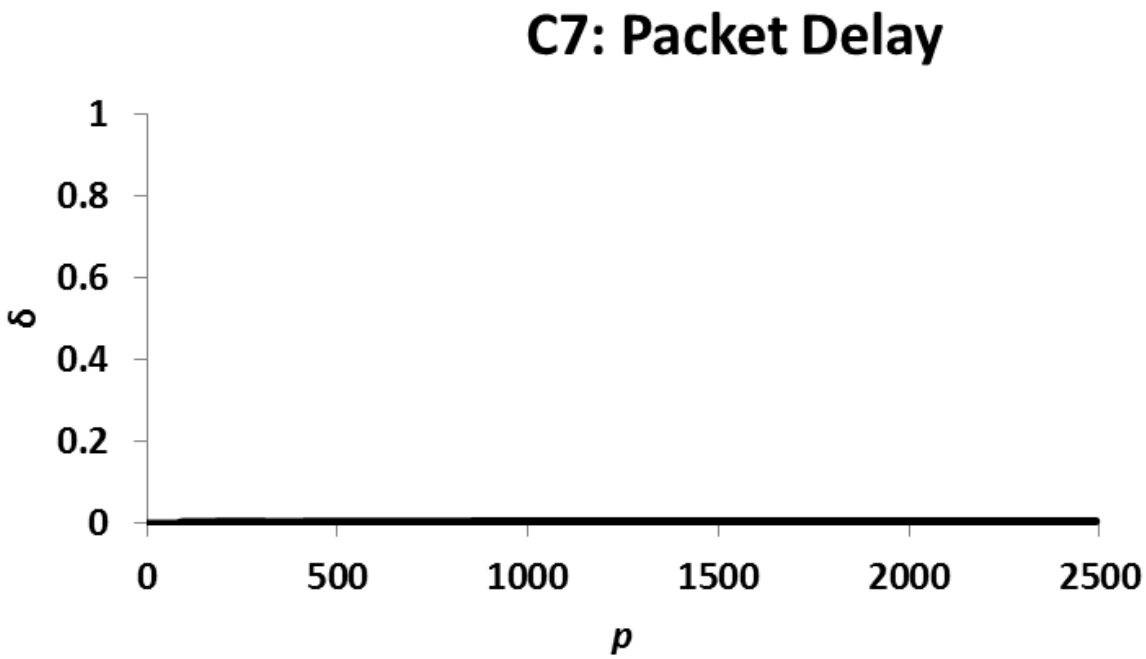

C1: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

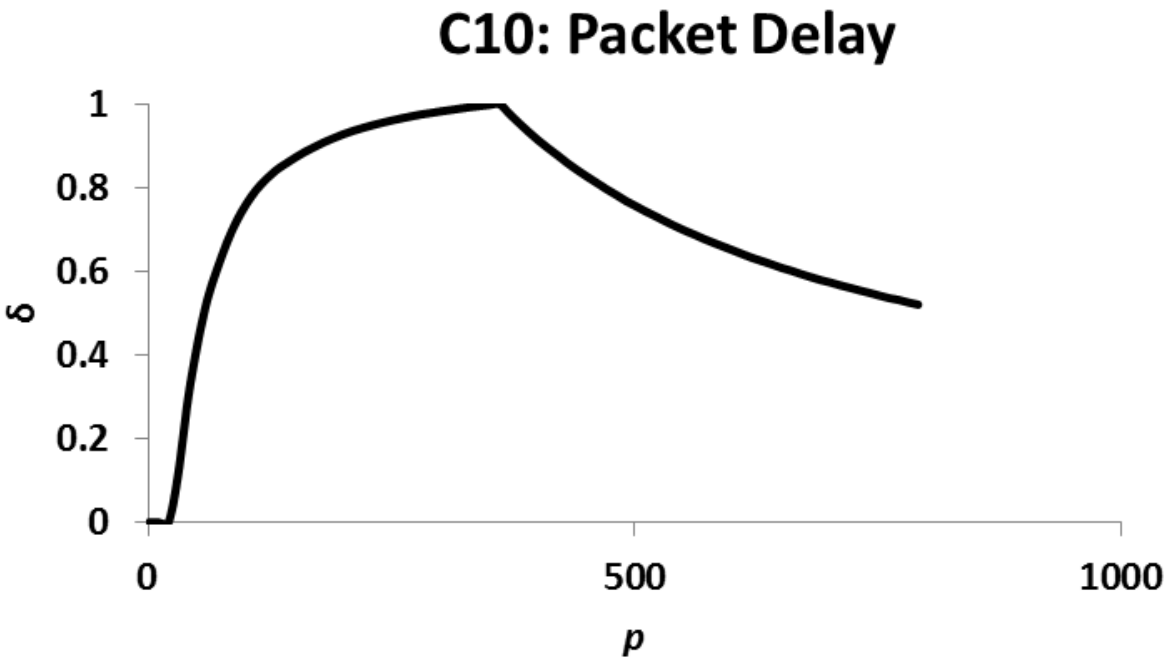

C2: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

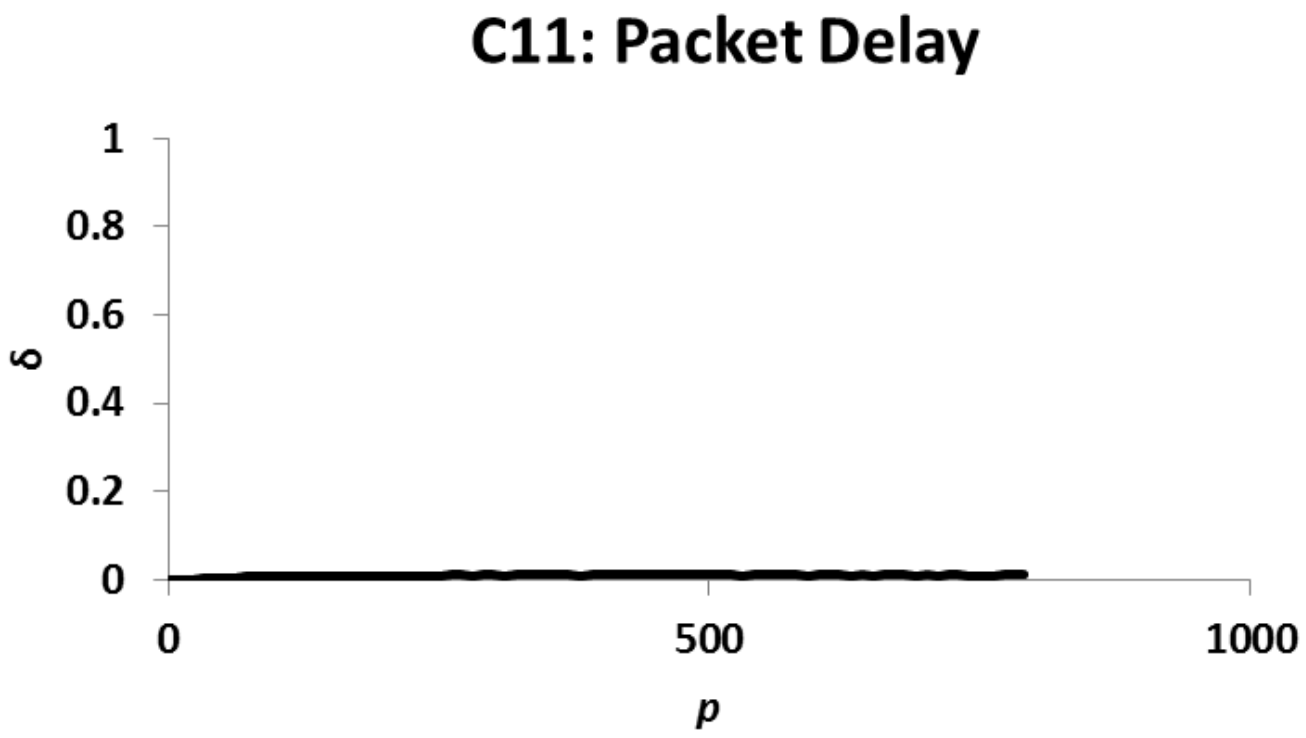
C3: Packet Delay

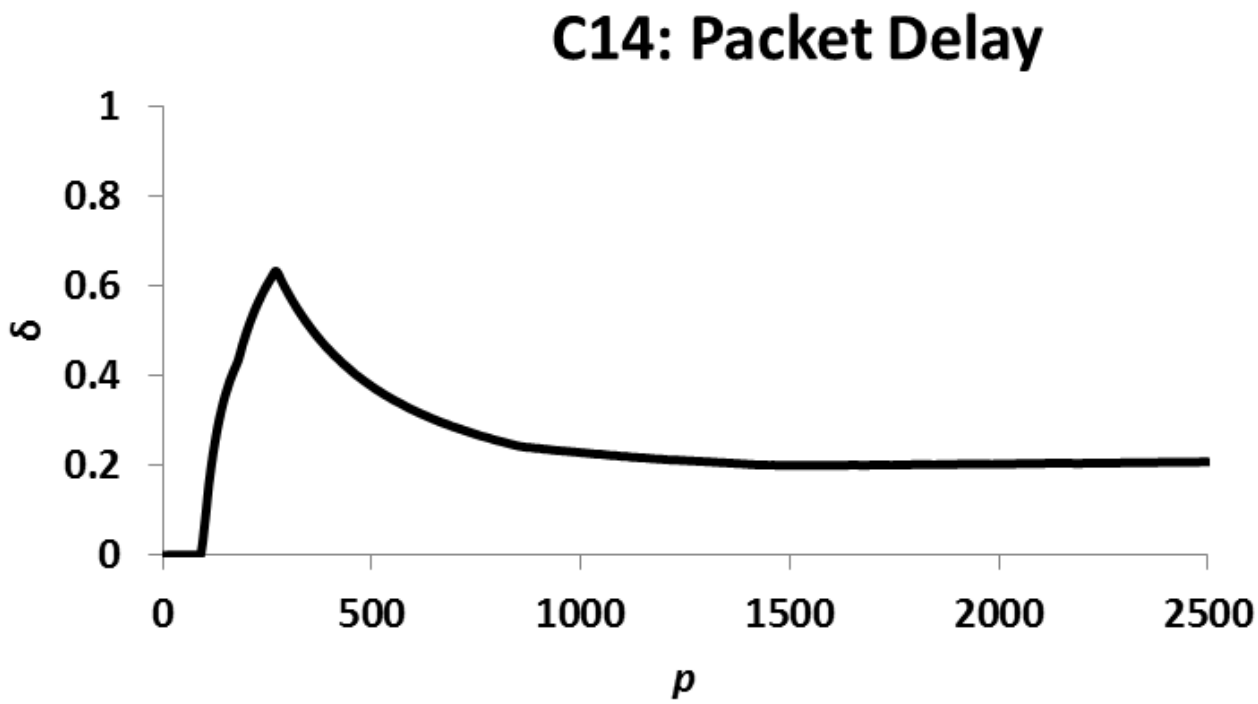


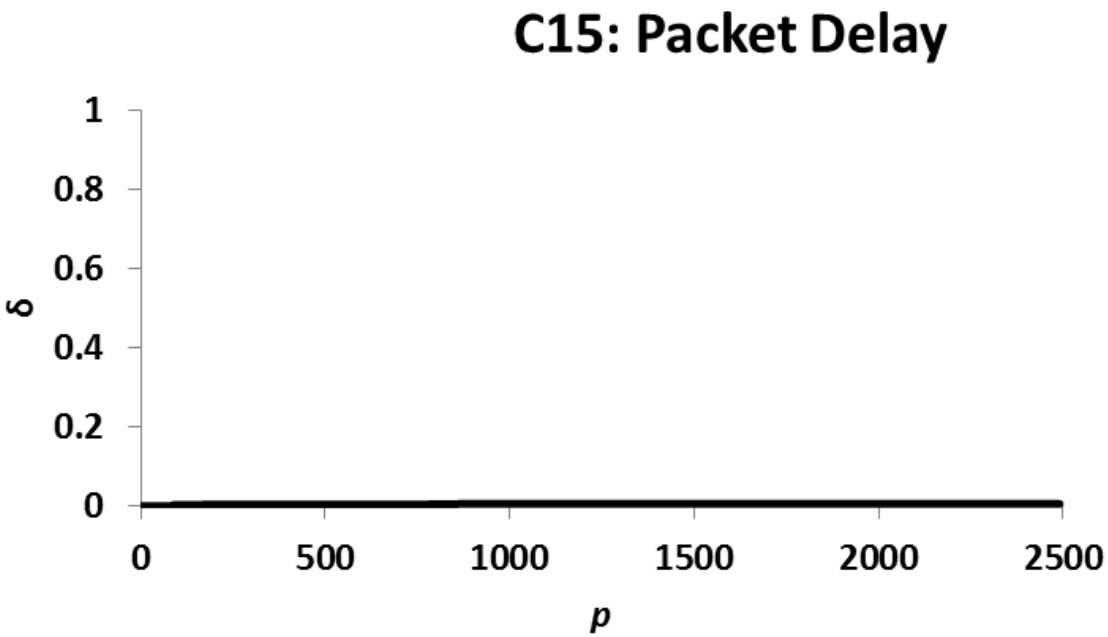

C6: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

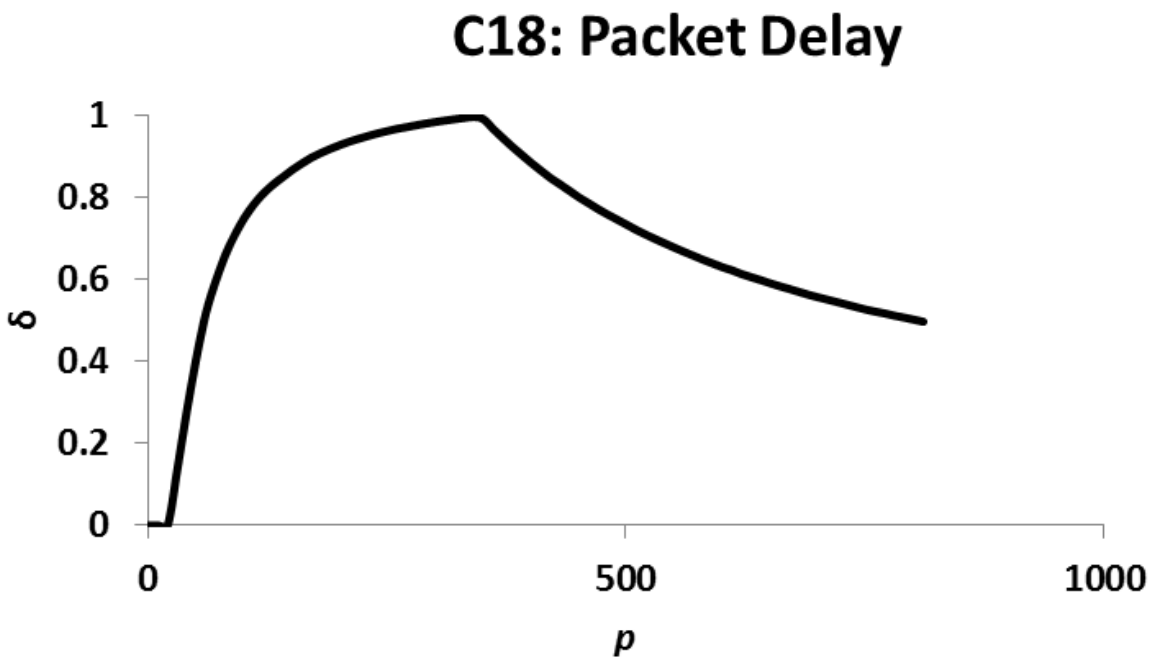

C7: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

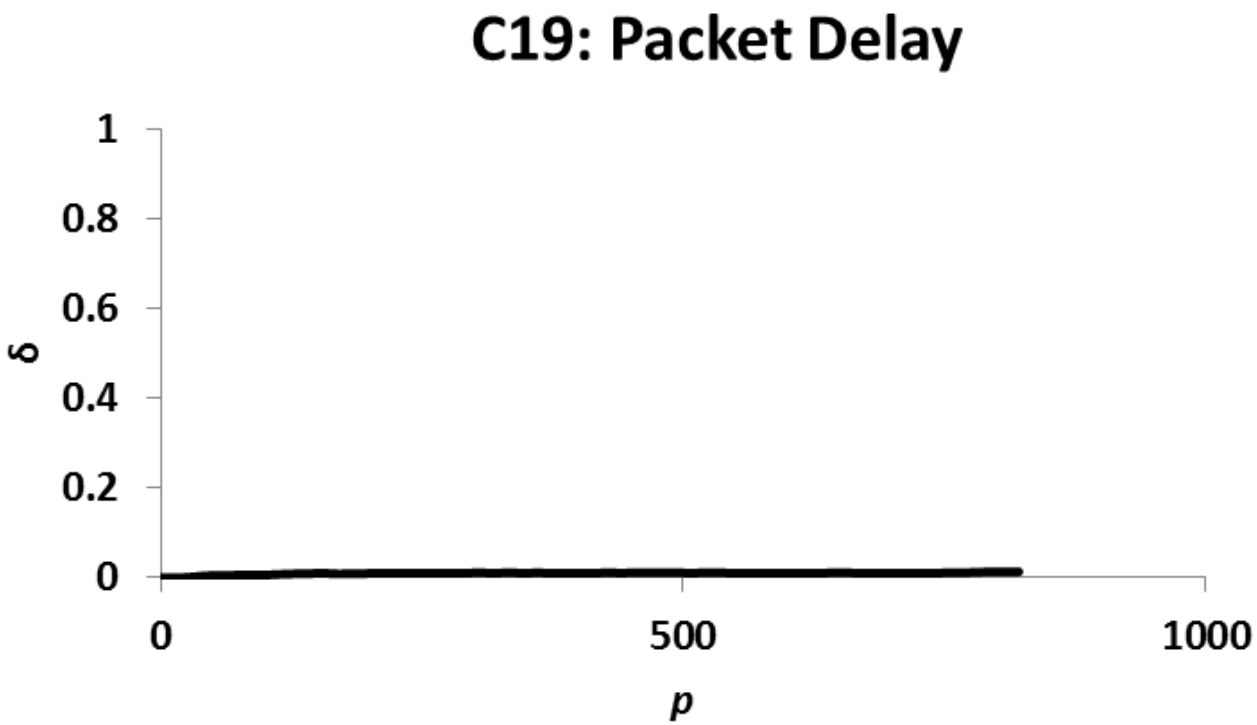

C10: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

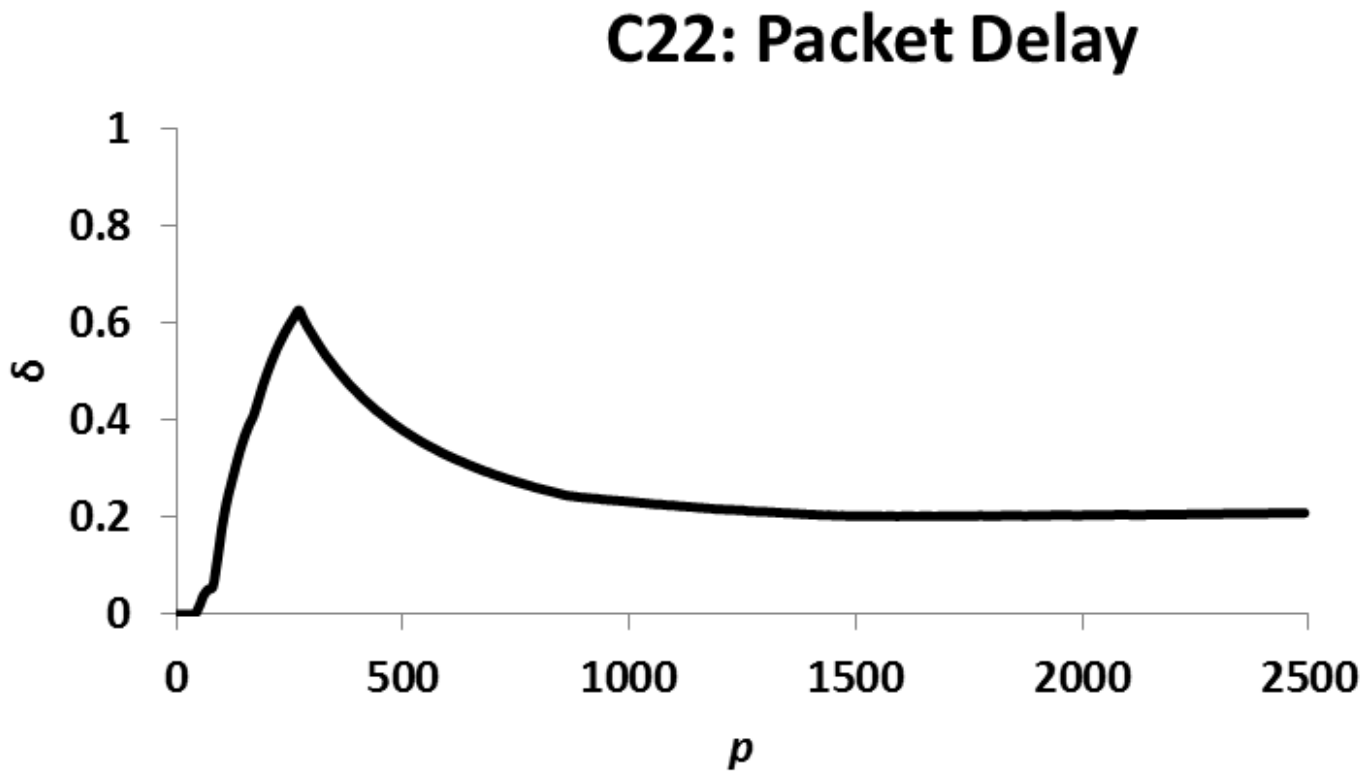

C11: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

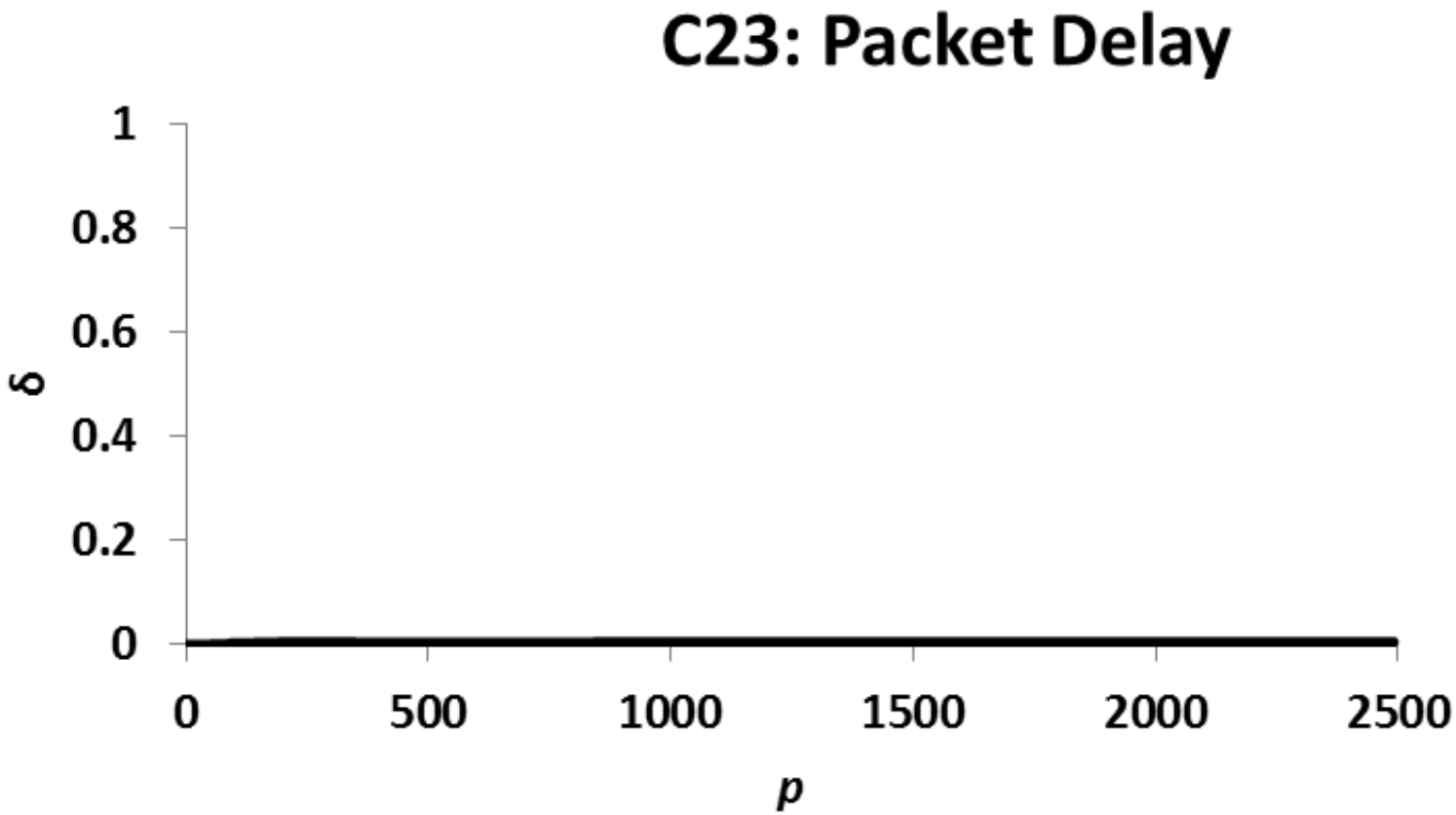

C14: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

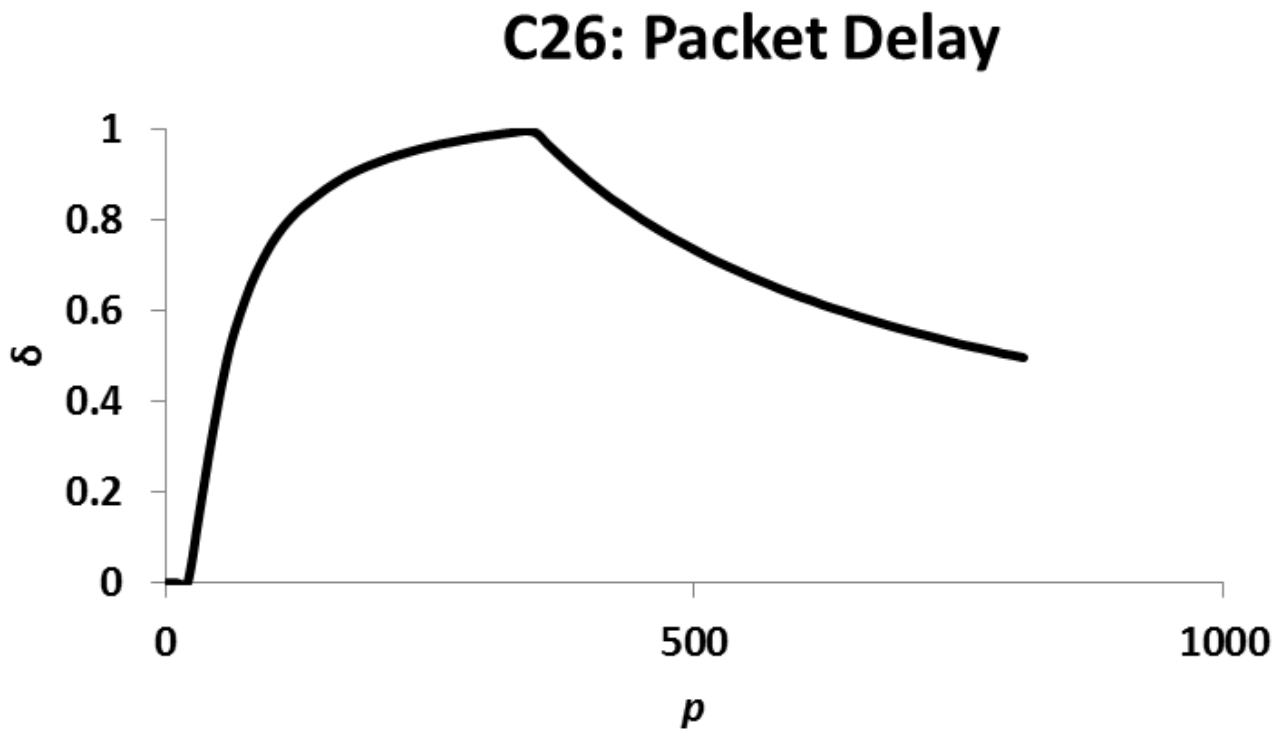

C15: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

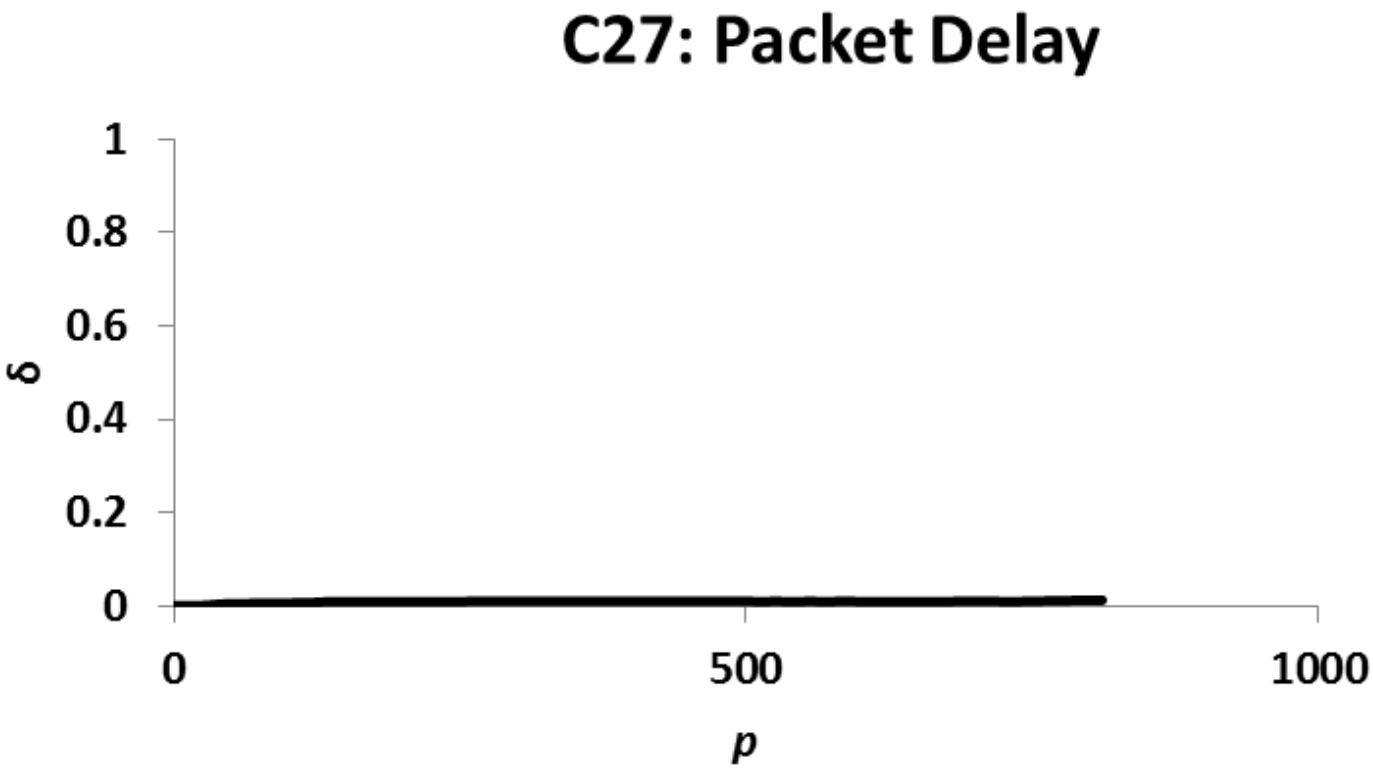

C18: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

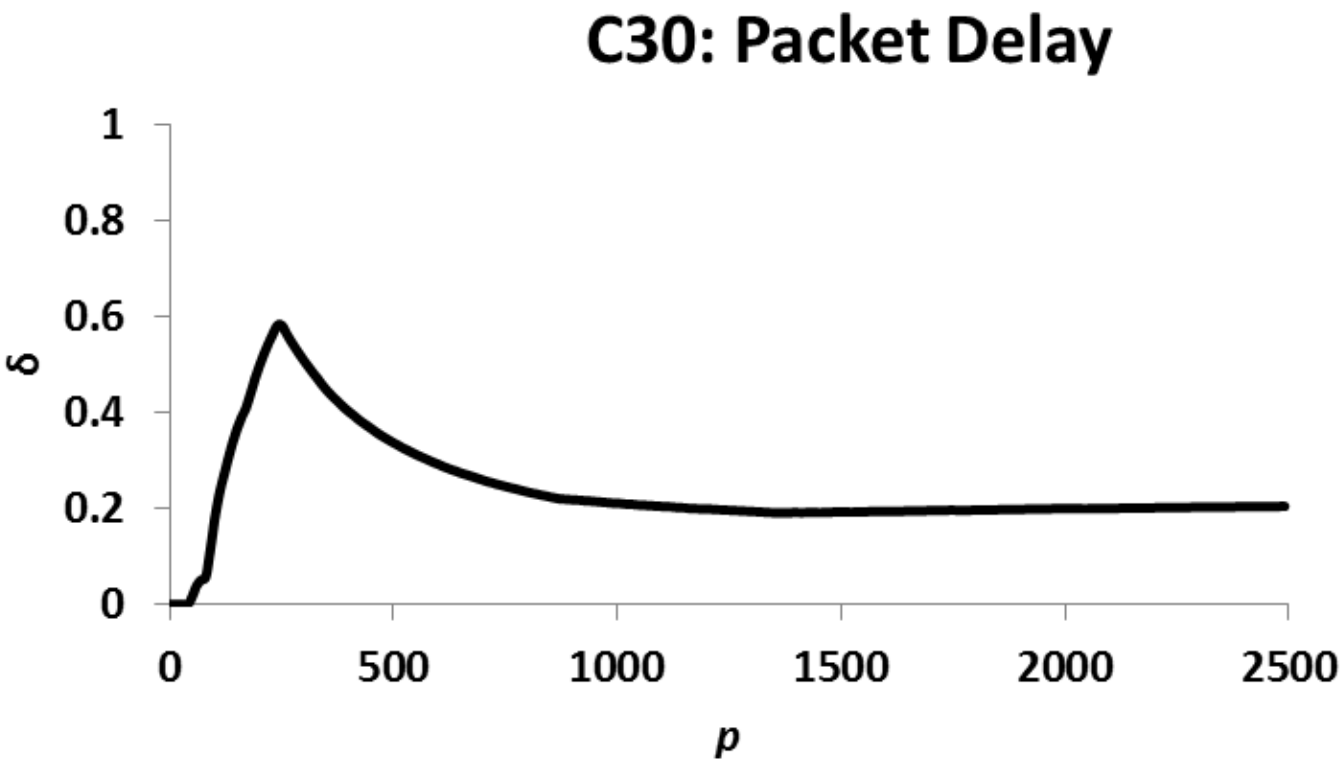

C19: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

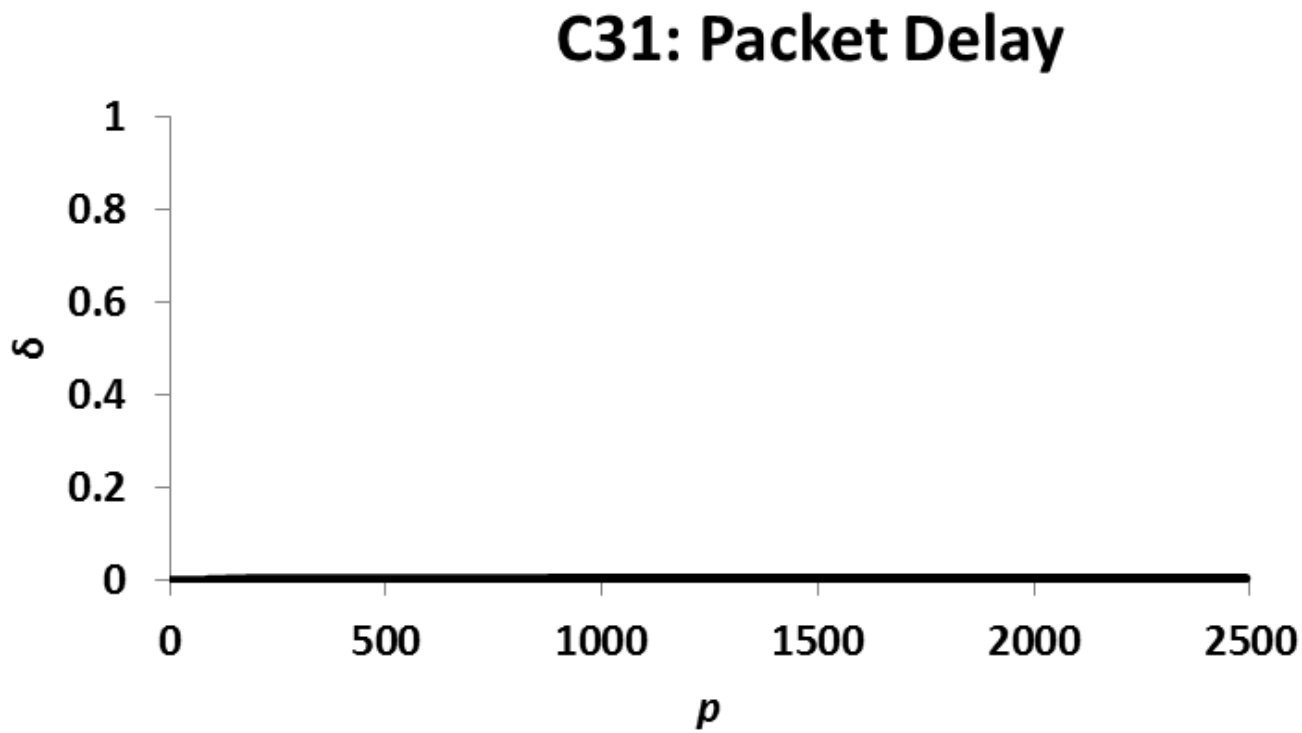

C22: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

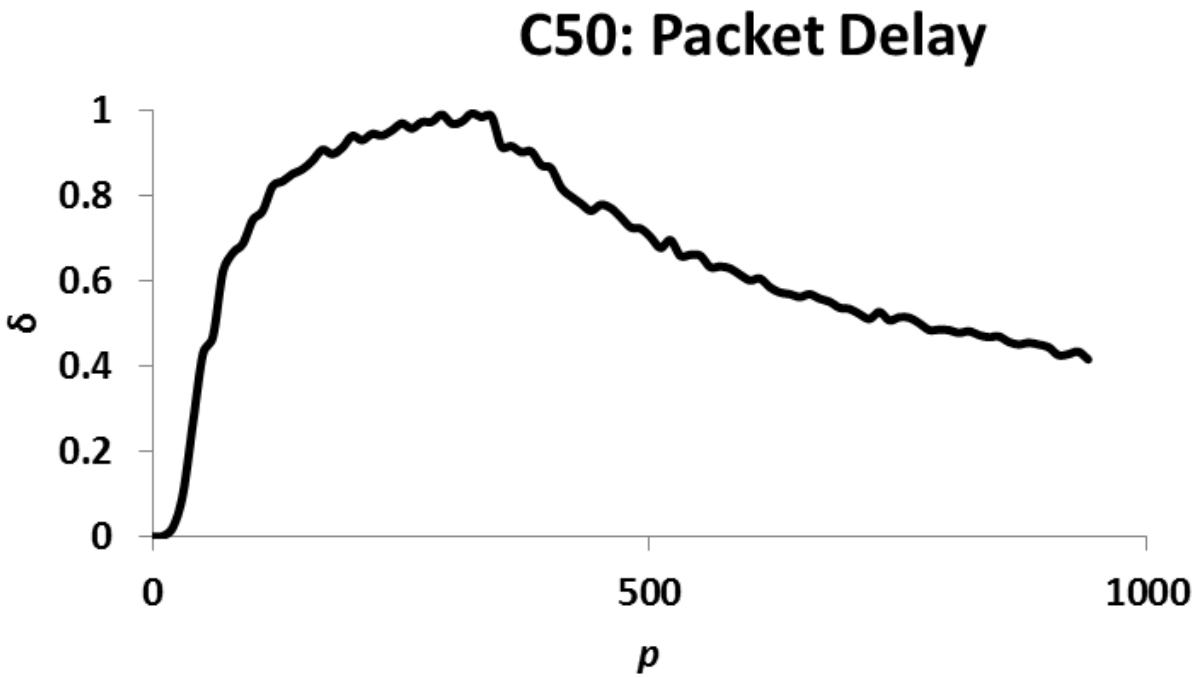

C23: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

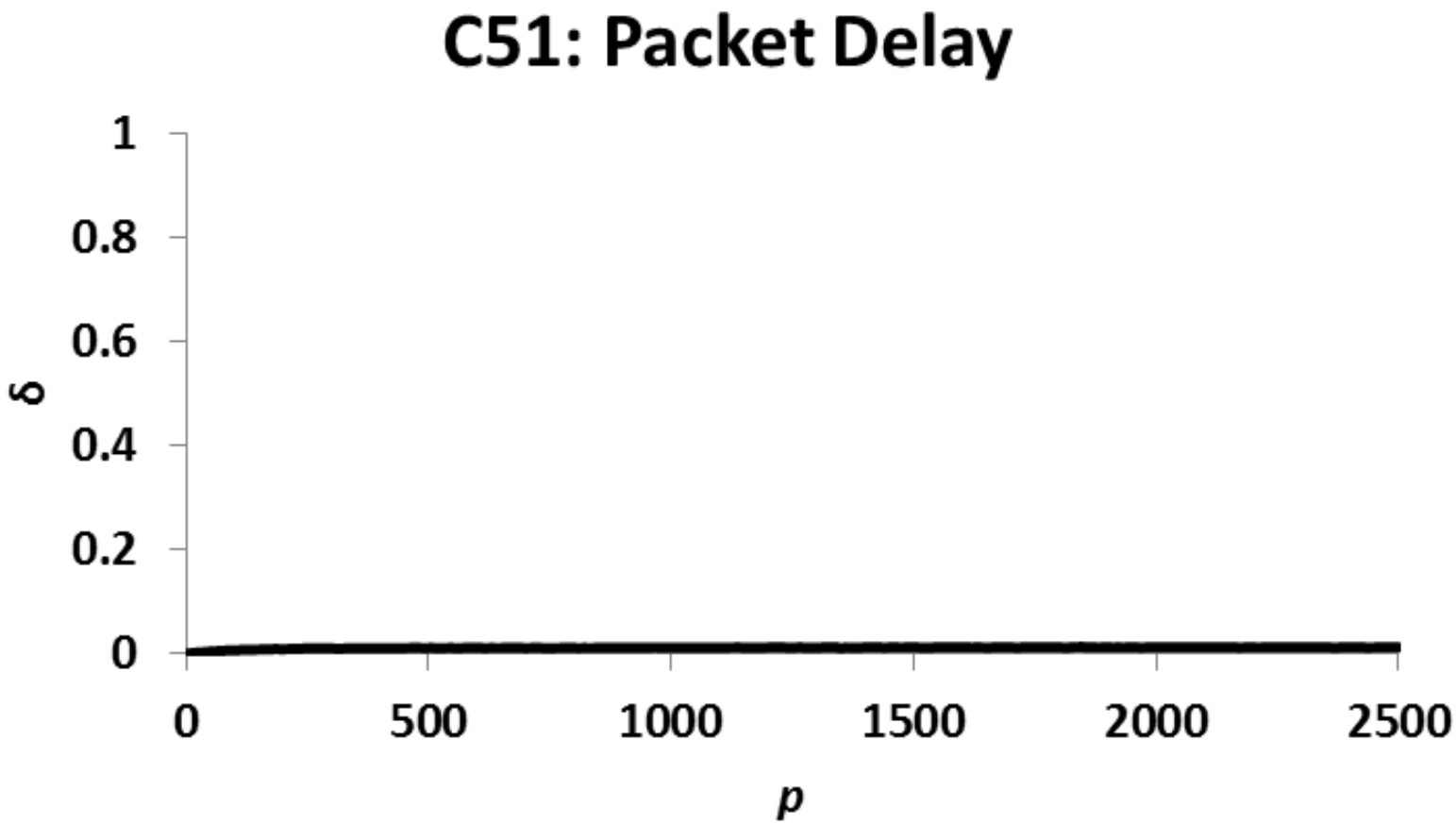

C26: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

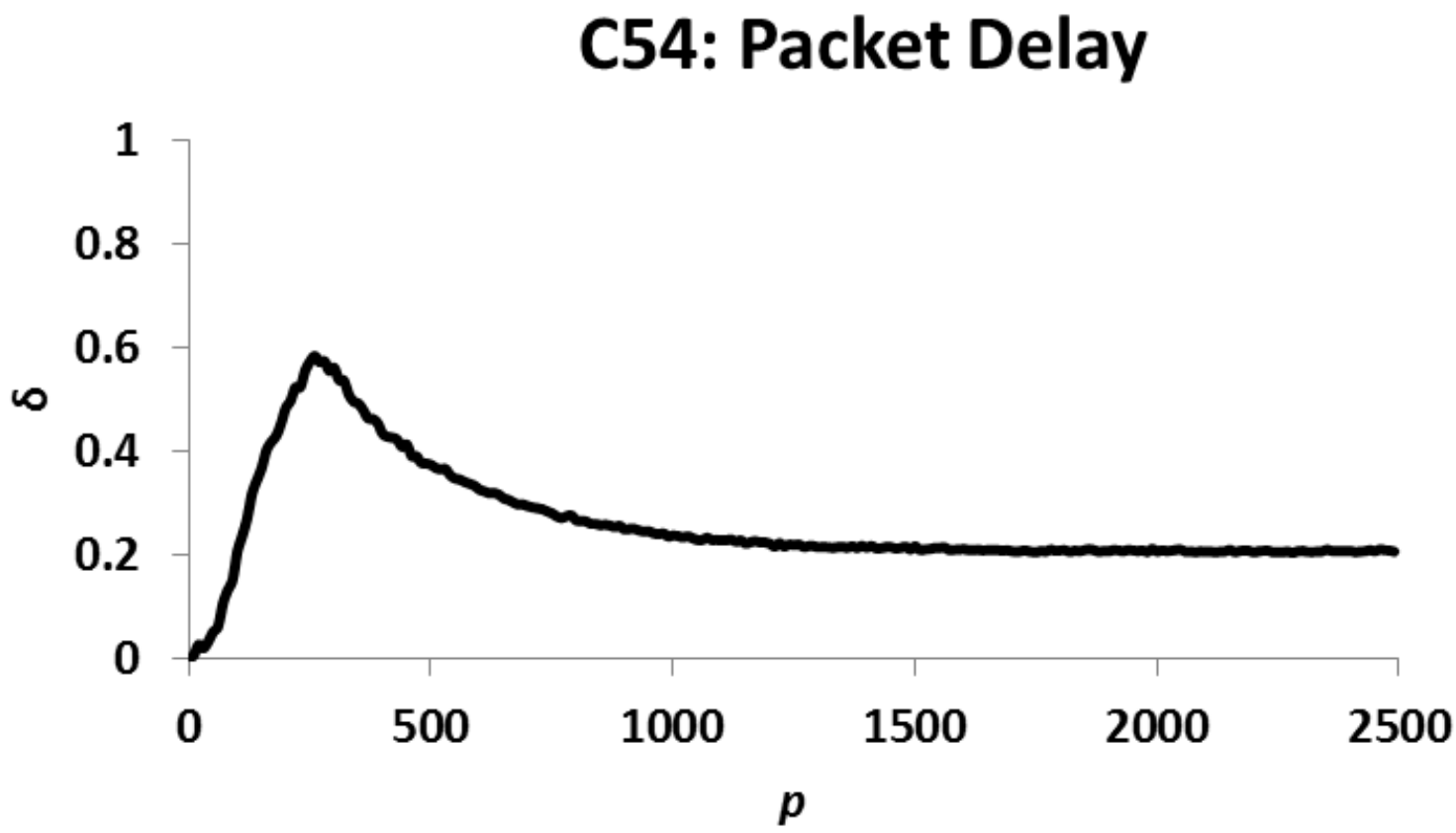

C27: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

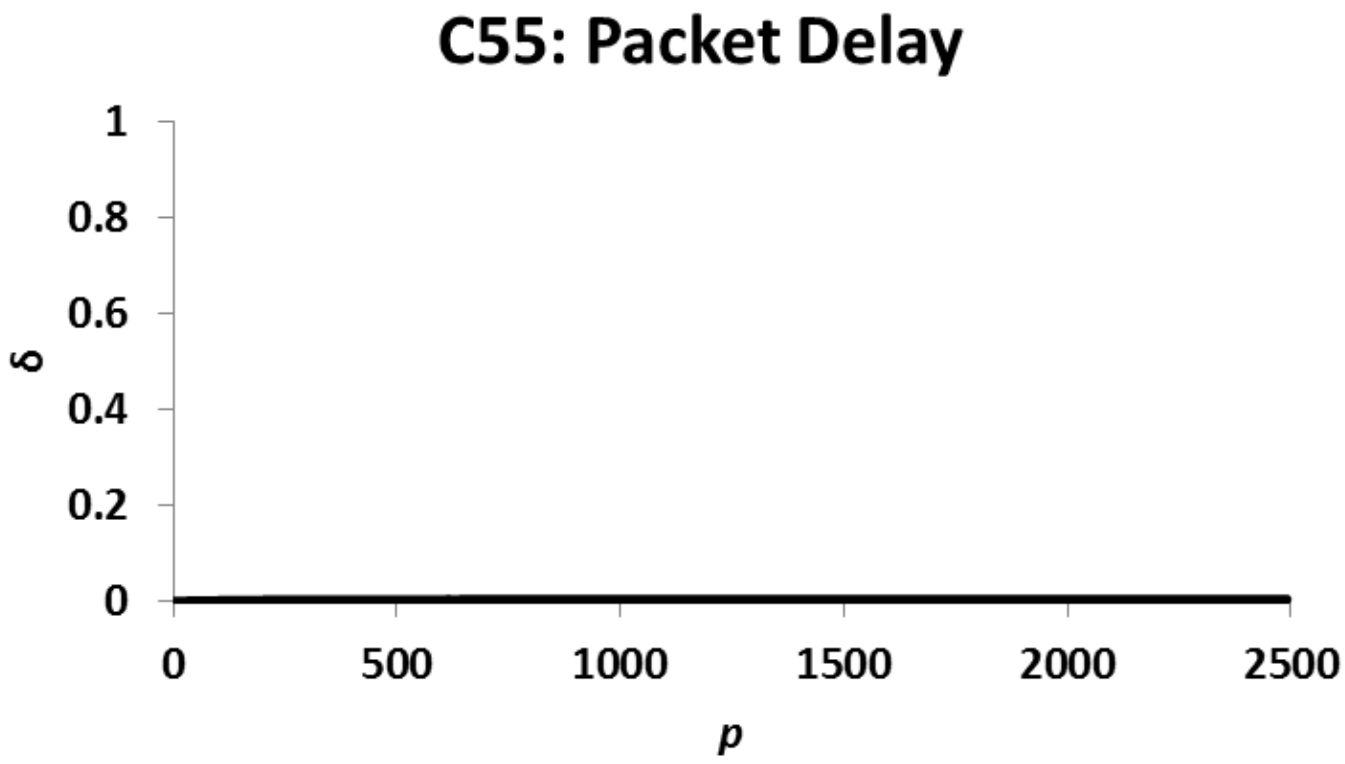

C30: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

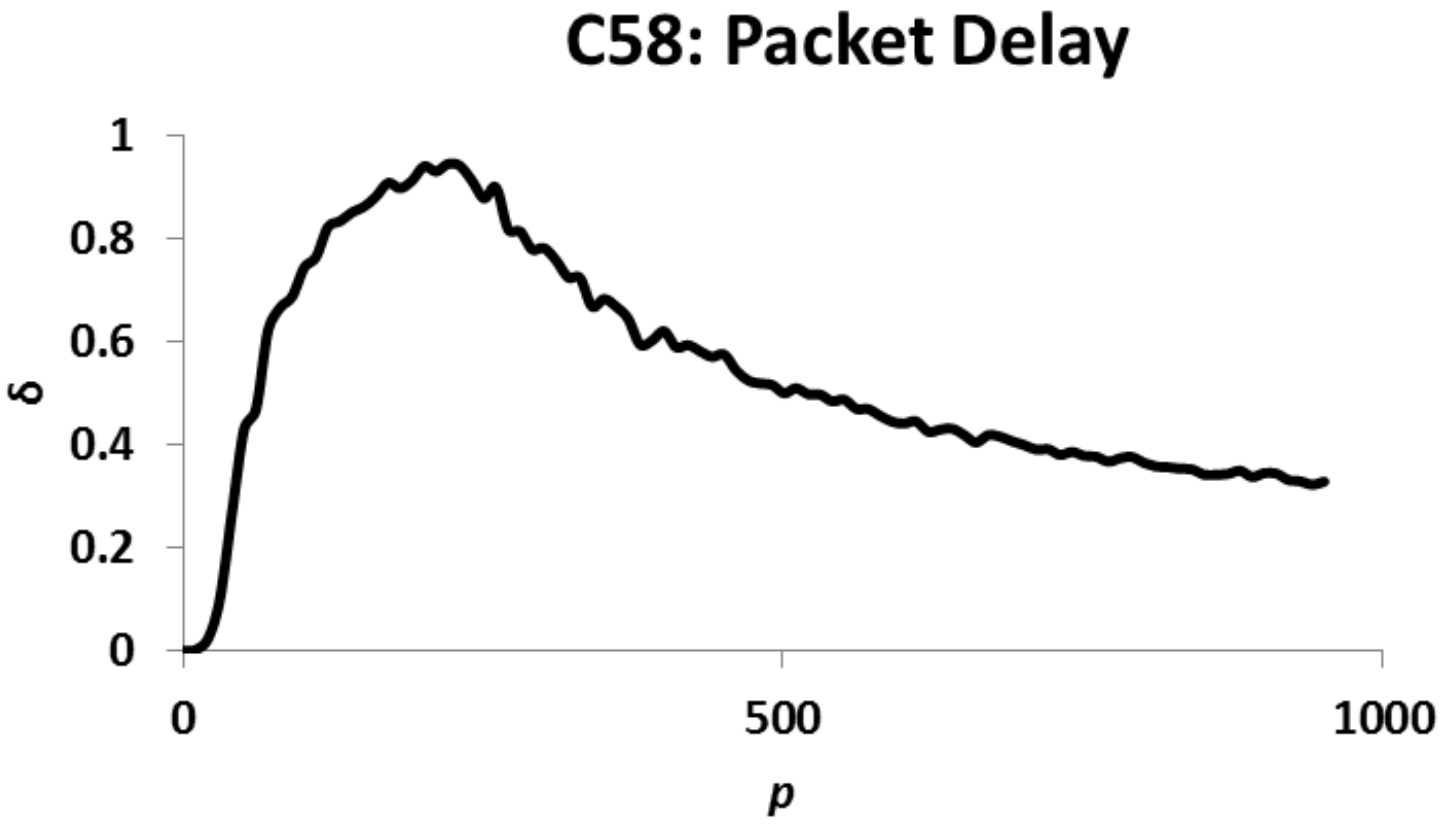

C31: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

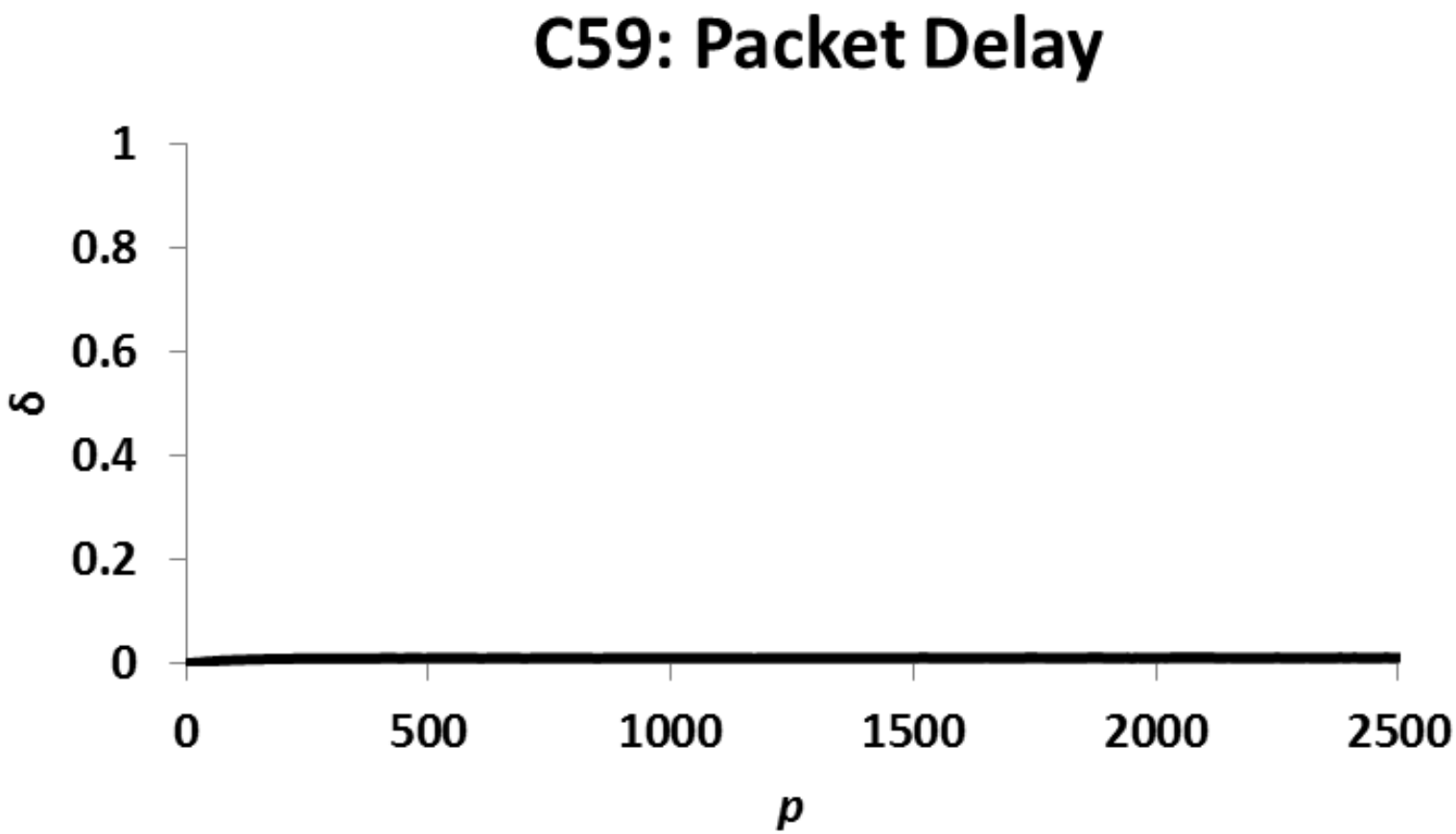

C50: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

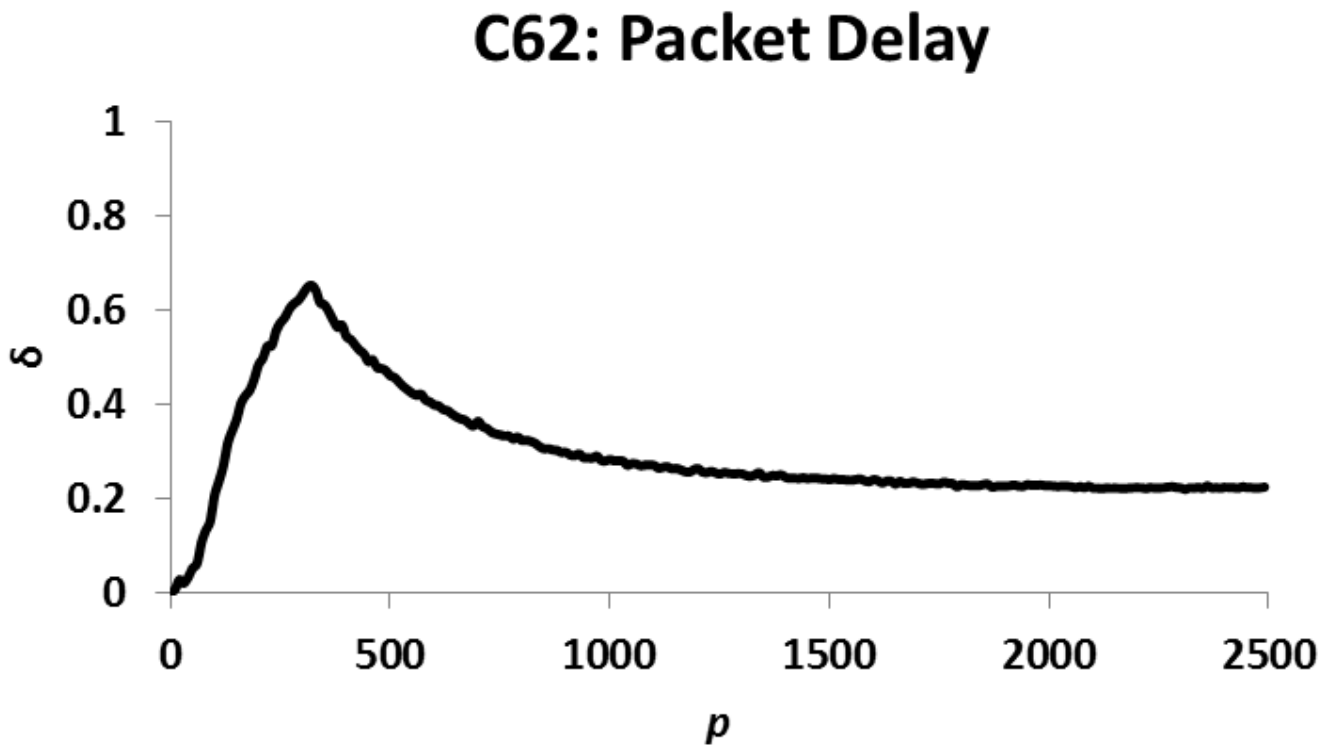

C51: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

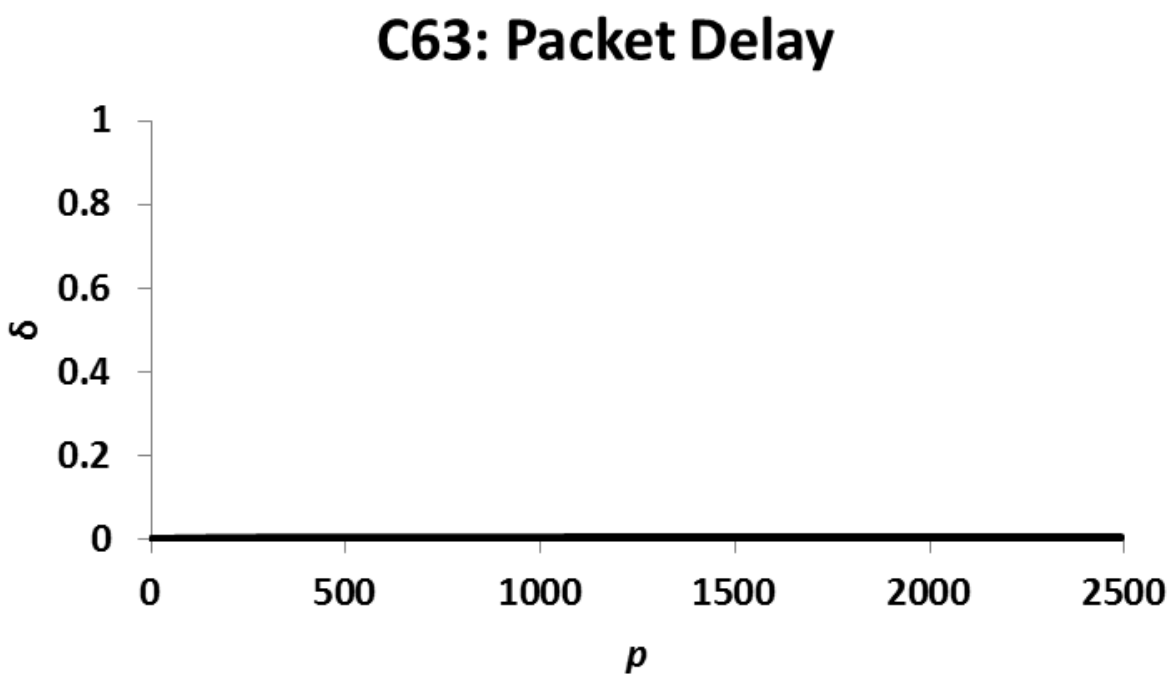

C54: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

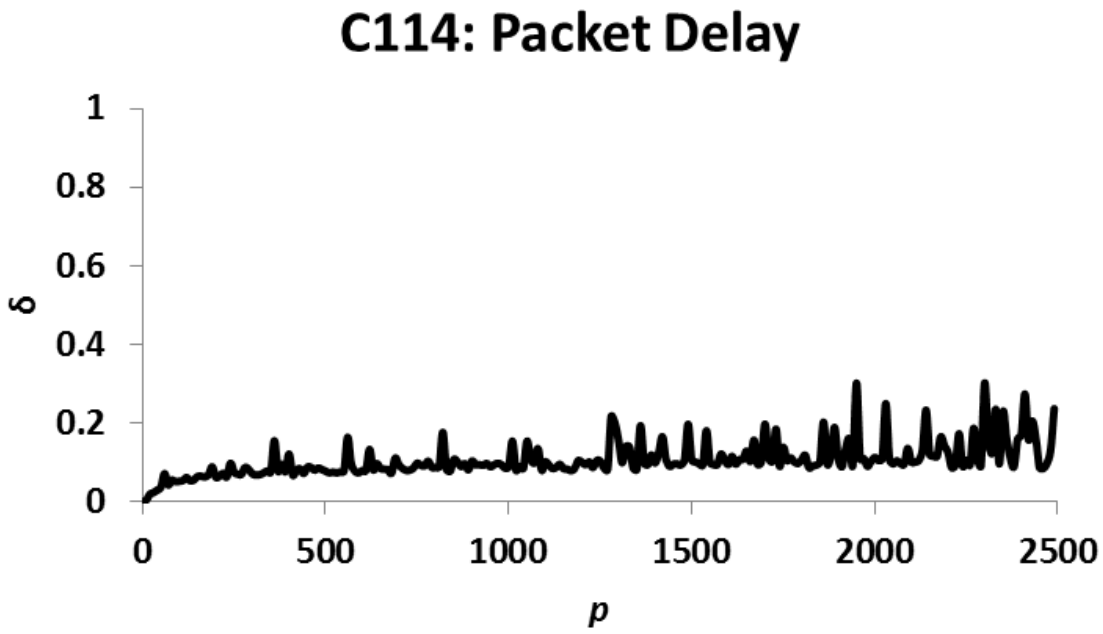

C55: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

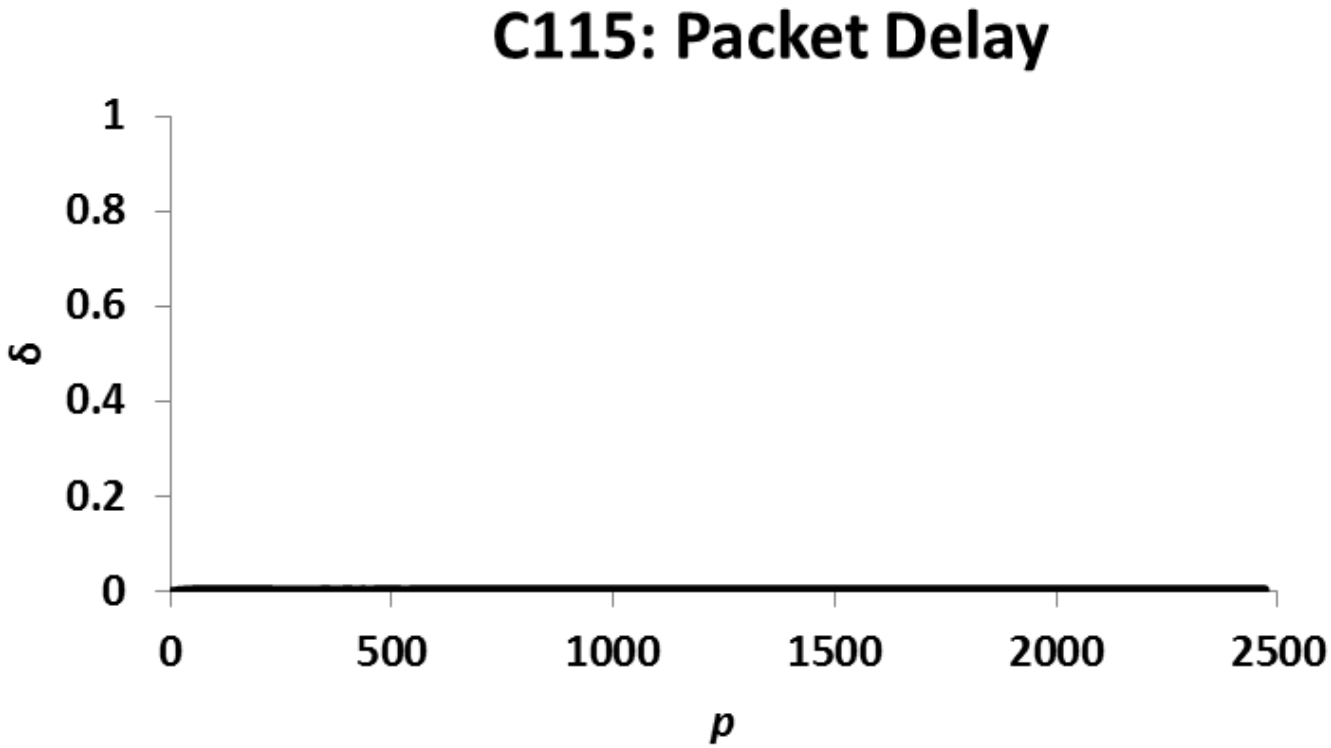

C58: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
p

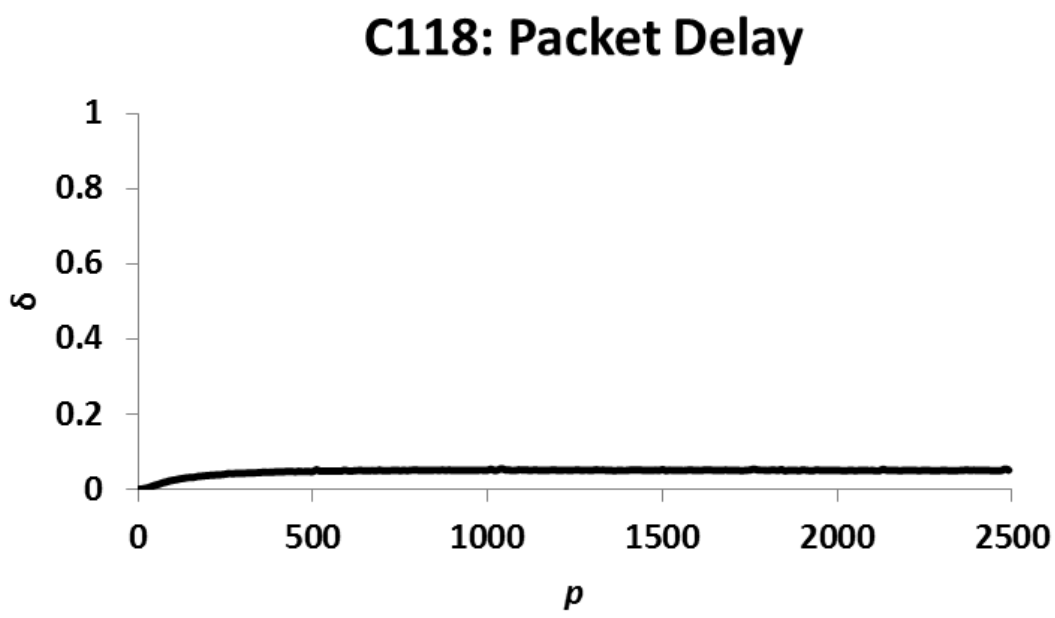

C59: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

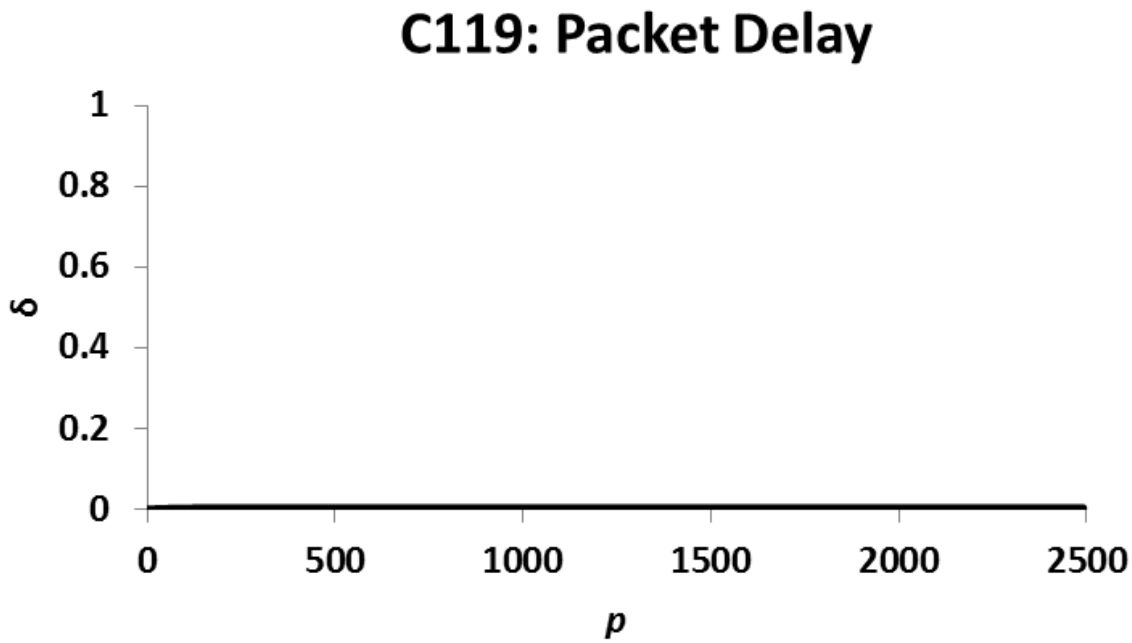

C62: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

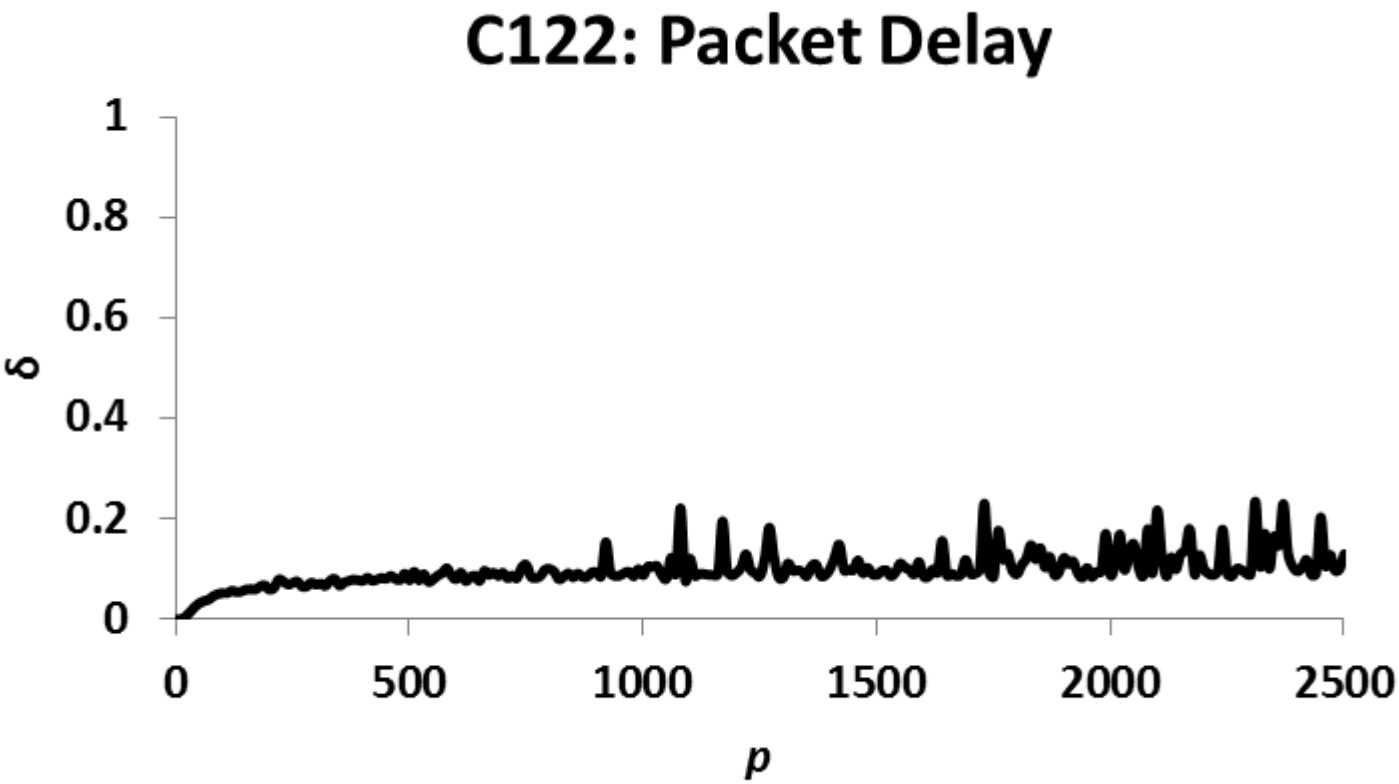

C63: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

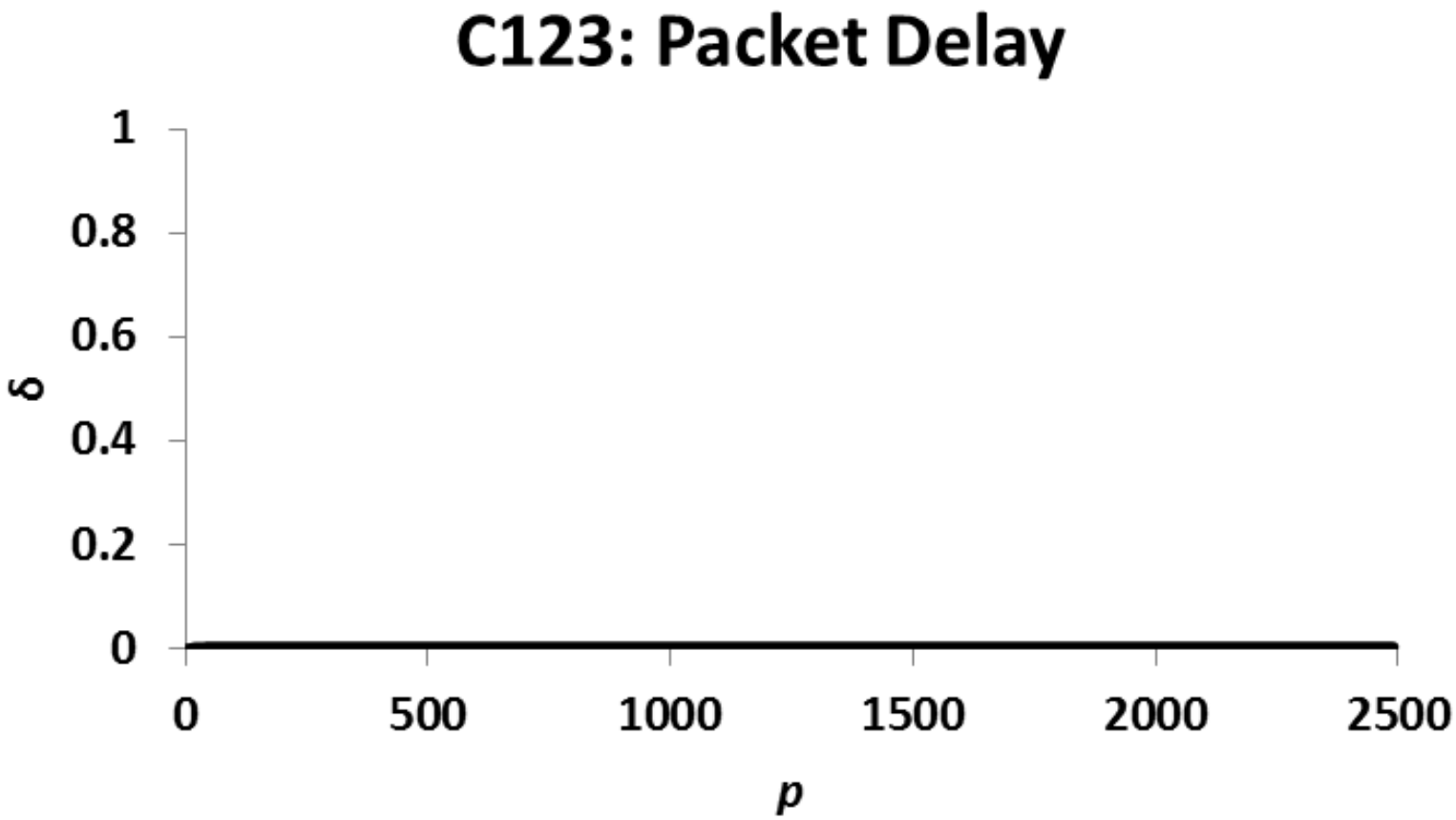

C114: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

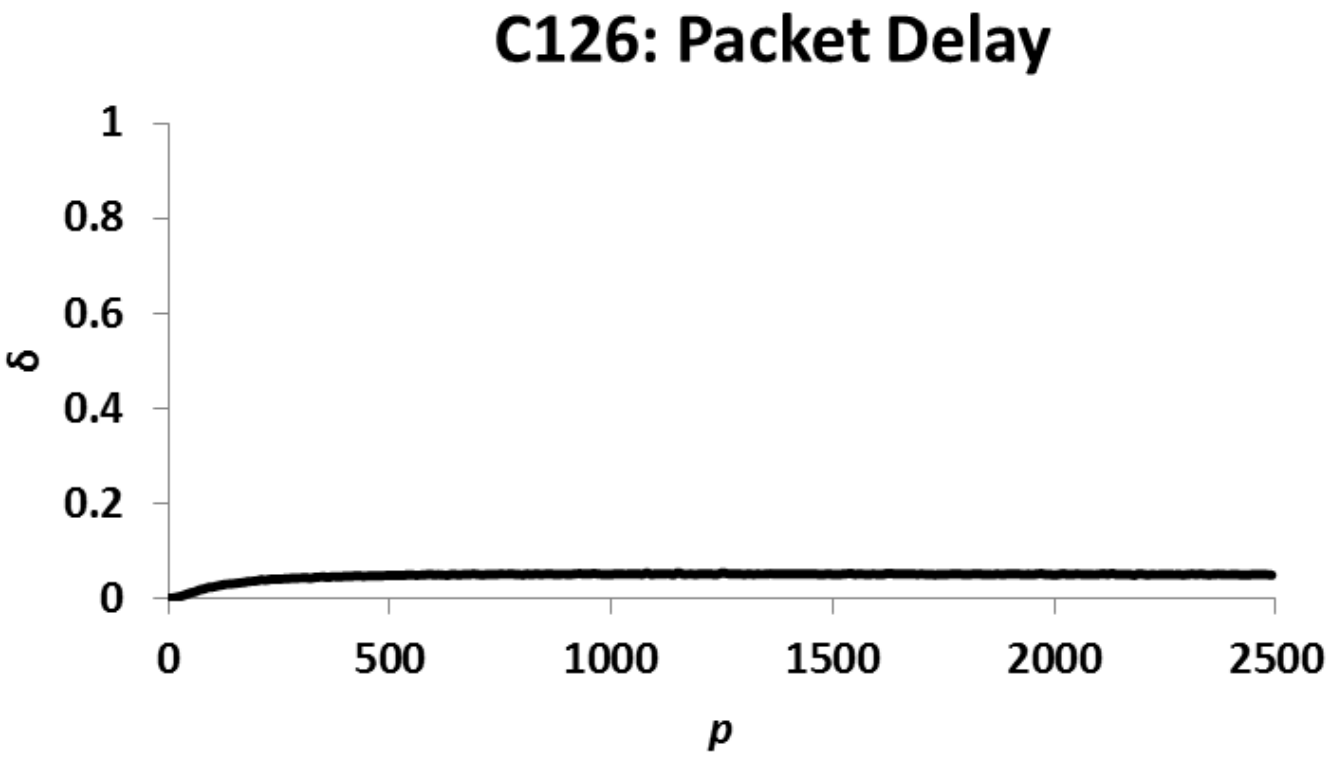

C115: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

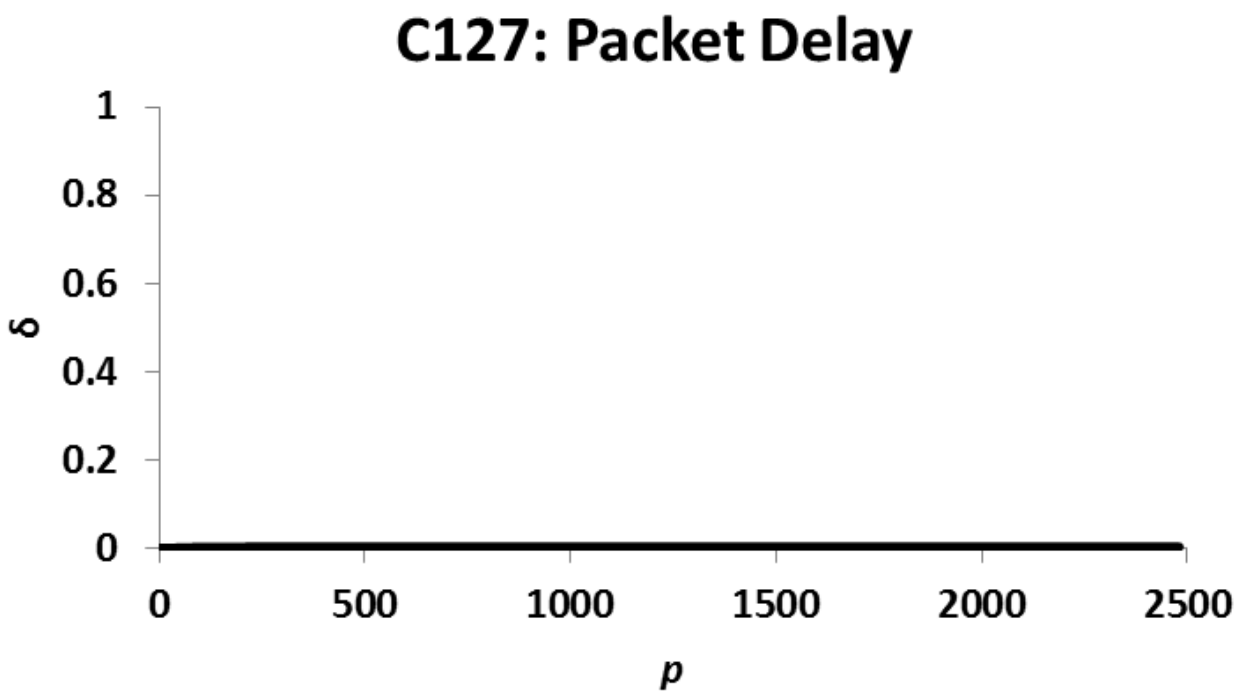

C118: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p


C119: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p


C122: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

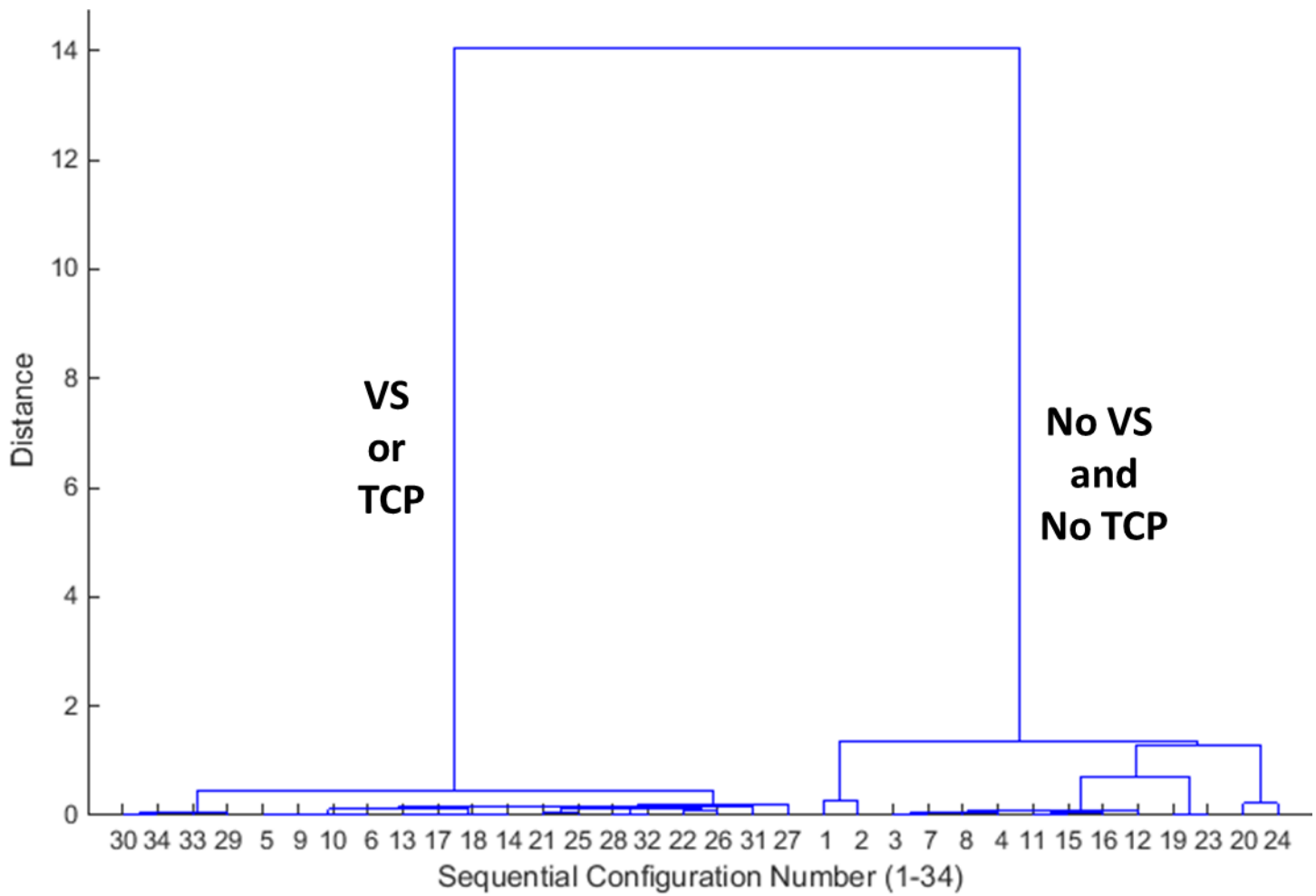

C123: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p


C126: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

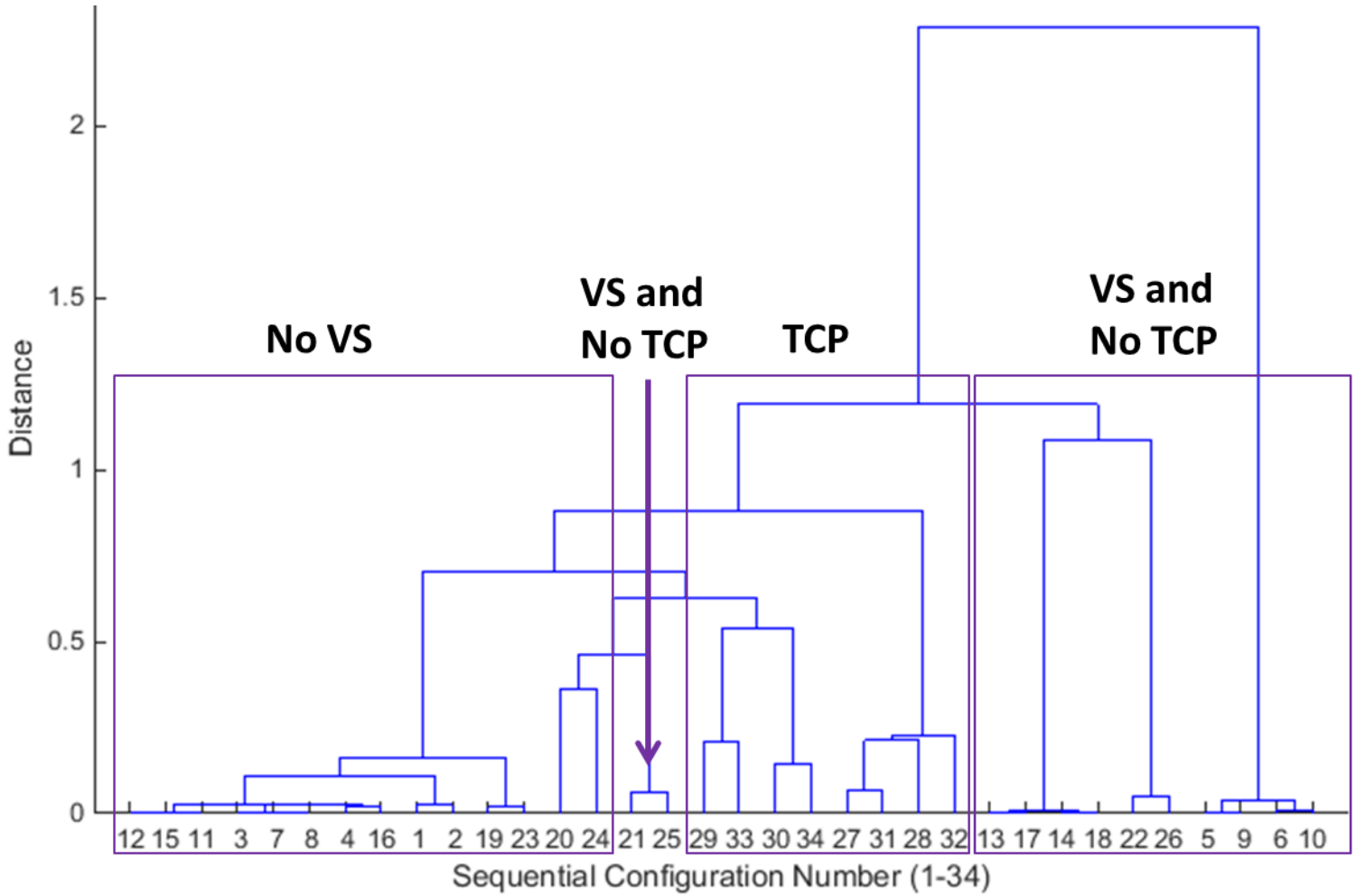

C127: Packet Delay
1
0.8
0.6
0.4
0.2
0
δ
0
500
1000
1500
2000
2500
p

Clustering for Each Response (χ, α, π and δ) Figures 27-30
(Dabrowski & Mills NIST)

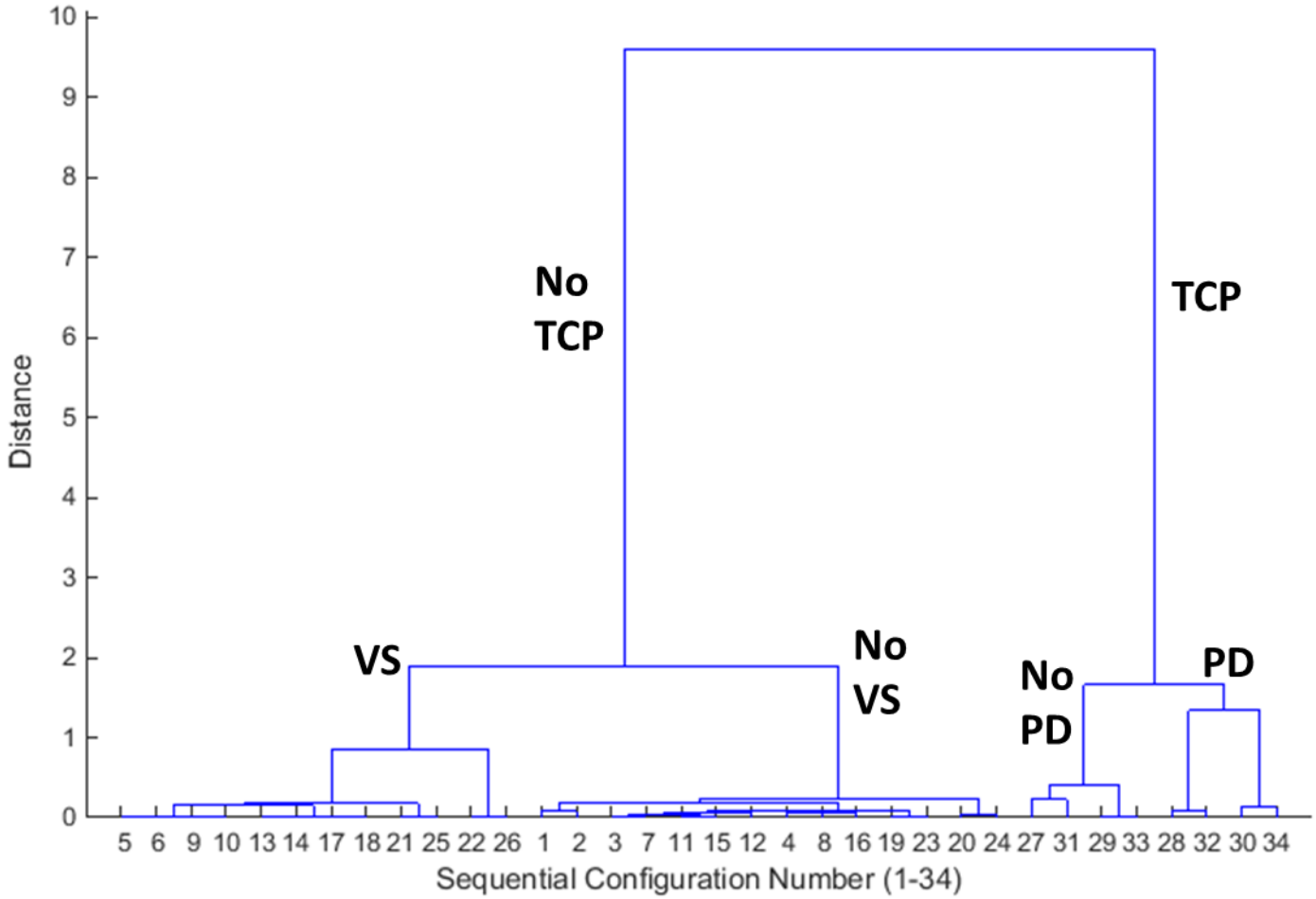
Hierarchical Clustering 2500 Series GCC Isolated Nodes (χ)



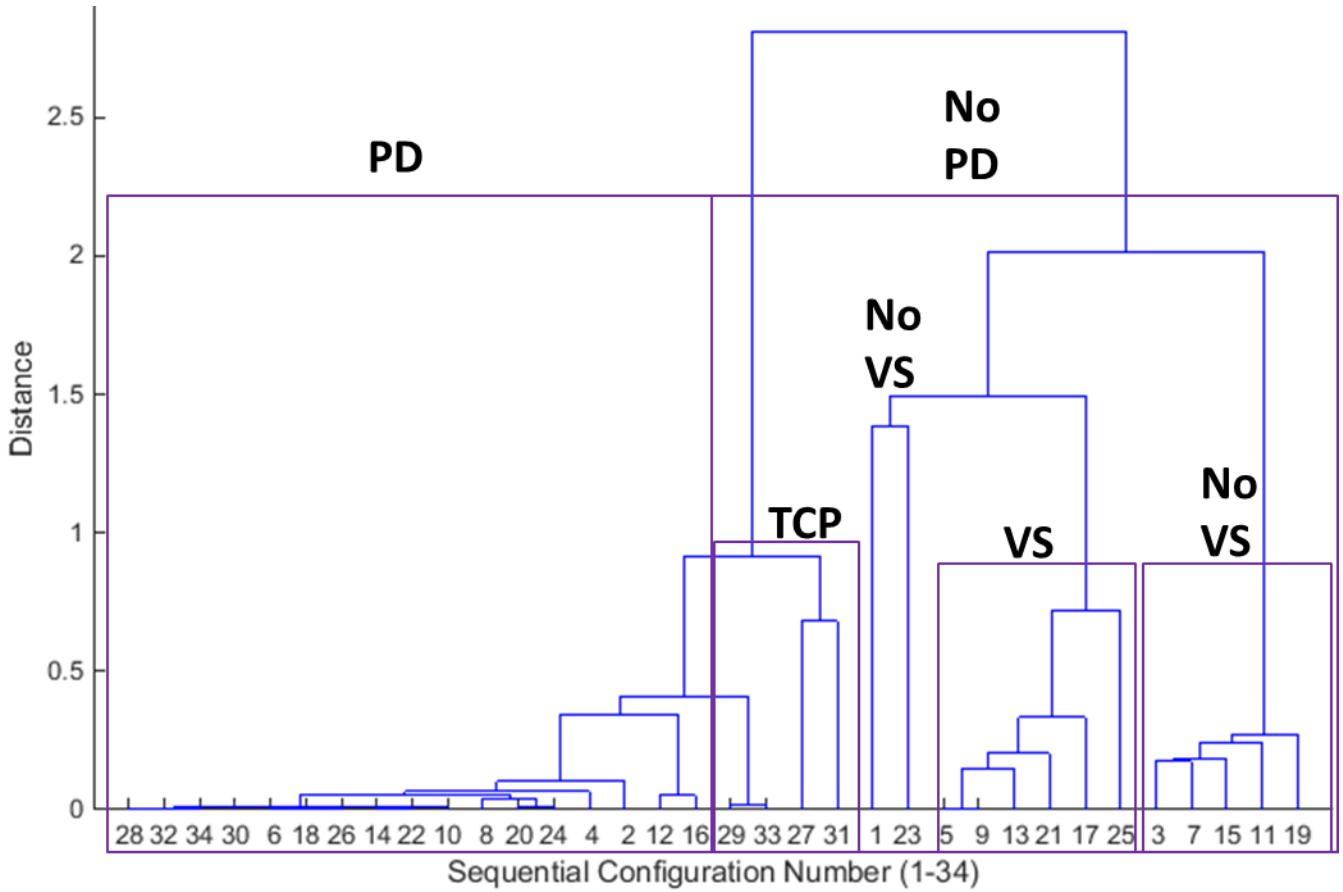
Hierarchical Clustering 2500 Series GCC Reachable Nodes (α)



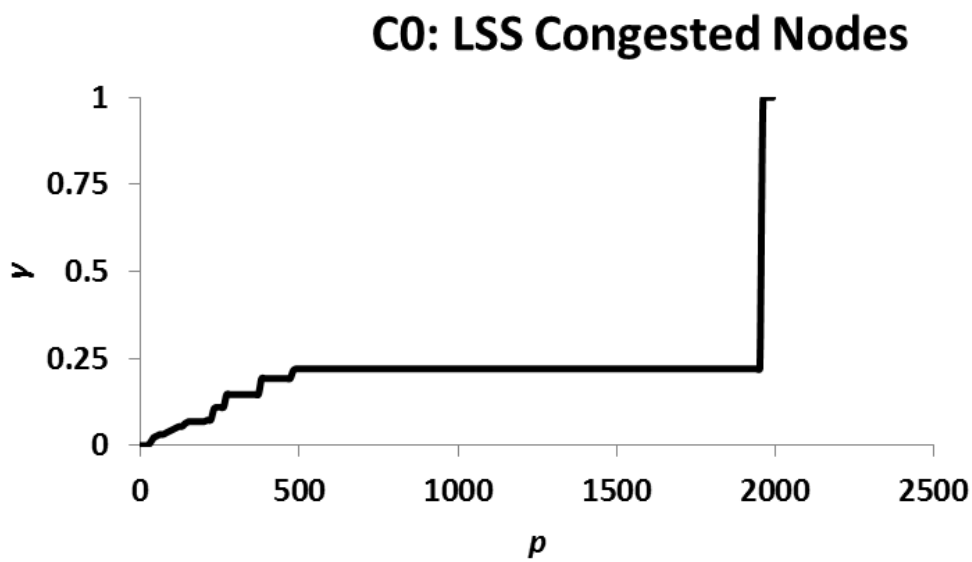
Hierarchical Clustering 2500 Series Proportion of Packets Delivered (π)

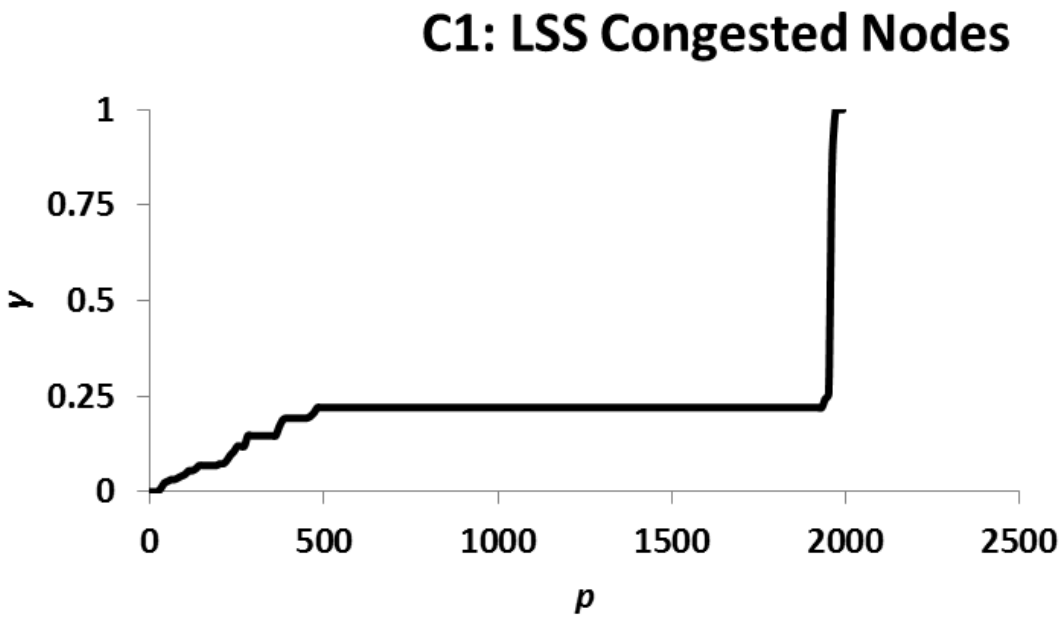


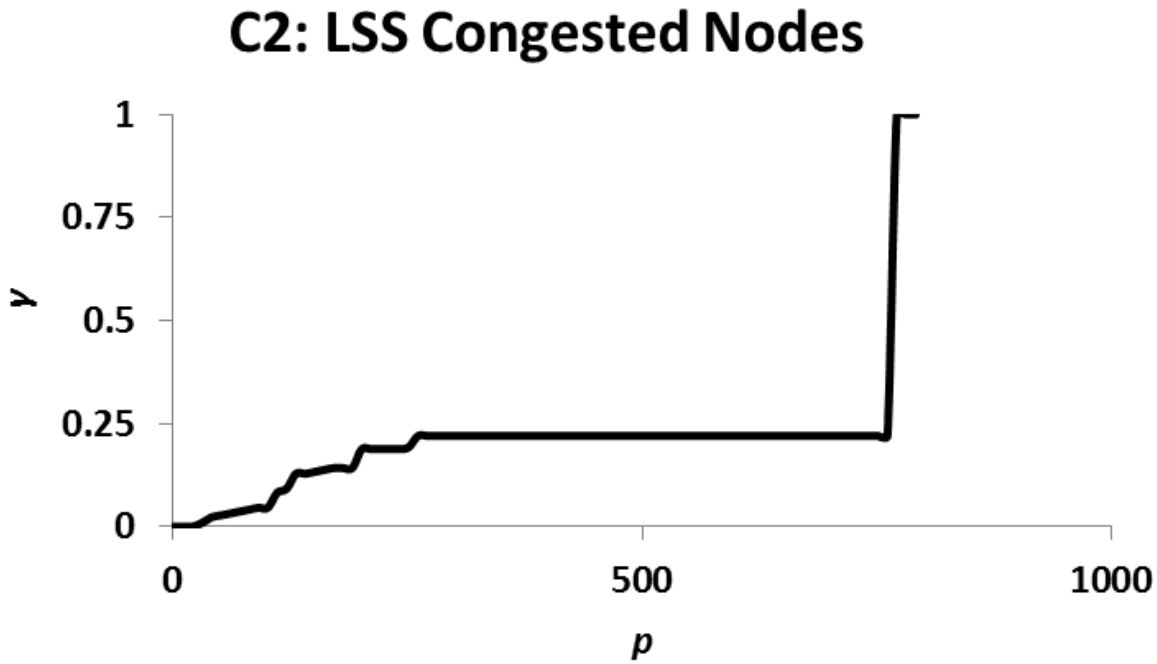
Hierarchical Clustering 2500 Series Scaled Packet Delays (δ)

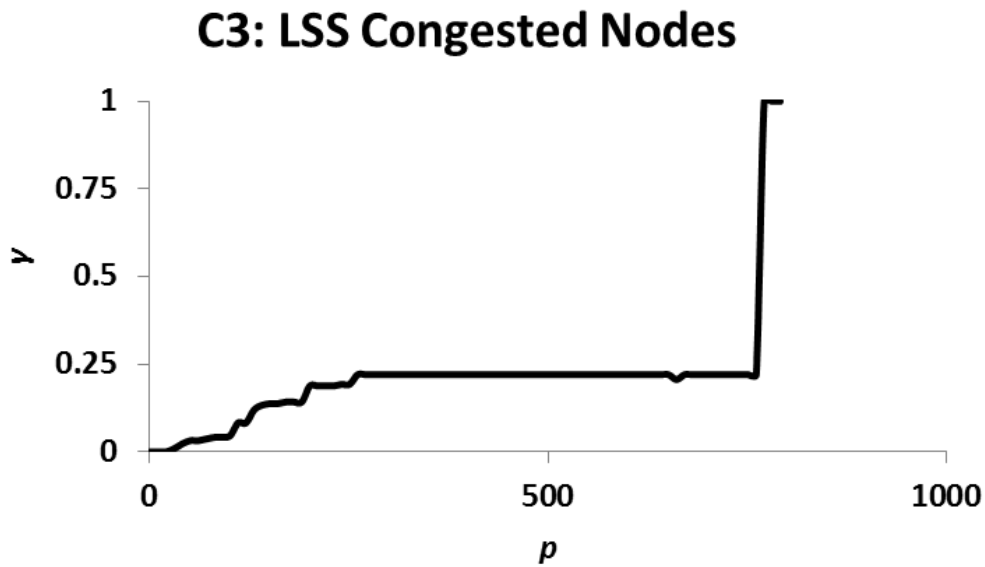


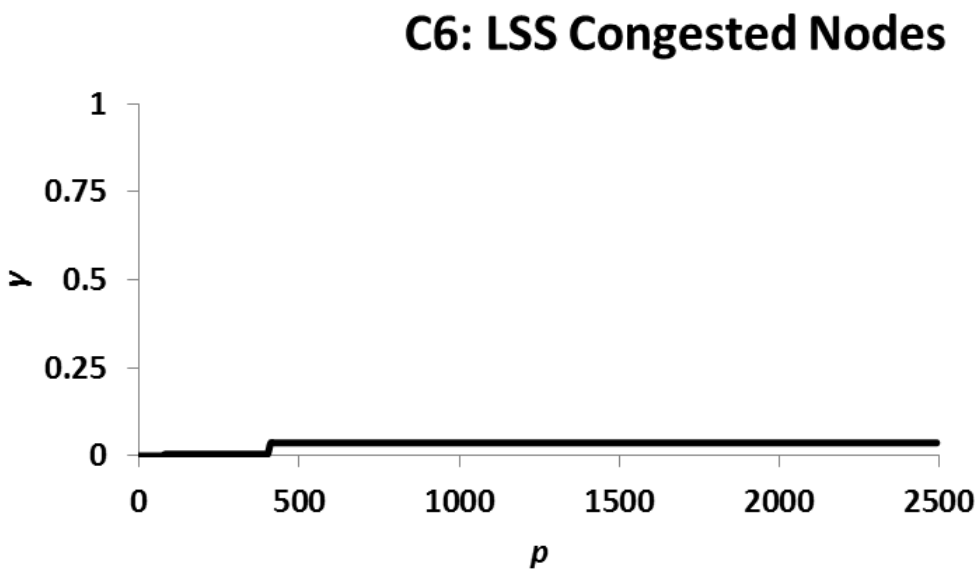
Graphs for Congested Nodes (*Y*) Figure A1
(Dabrowski & Mills NIST)

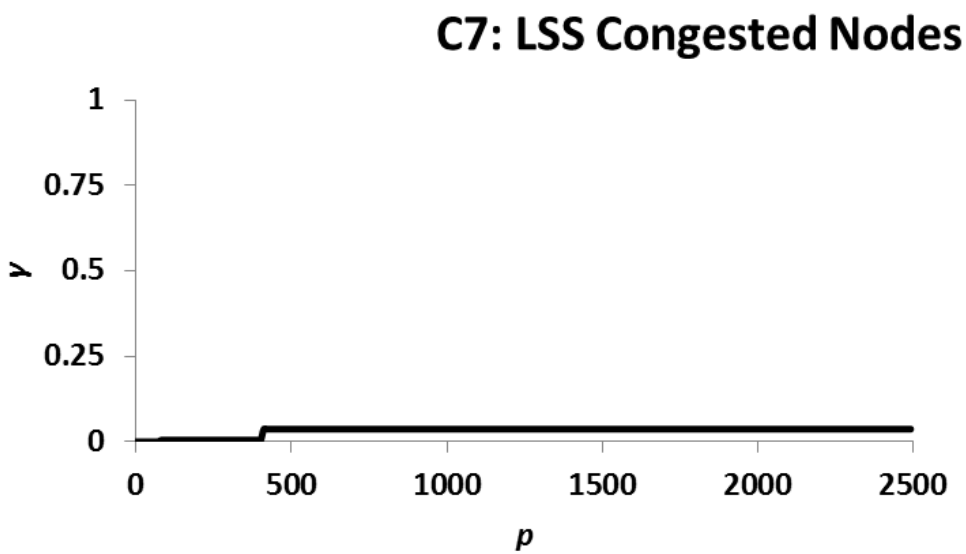

C0: LSS Congested Nodes
1
0.75
0.5
0.25
0
γ
0
500
1000
1500
2000
2500
p

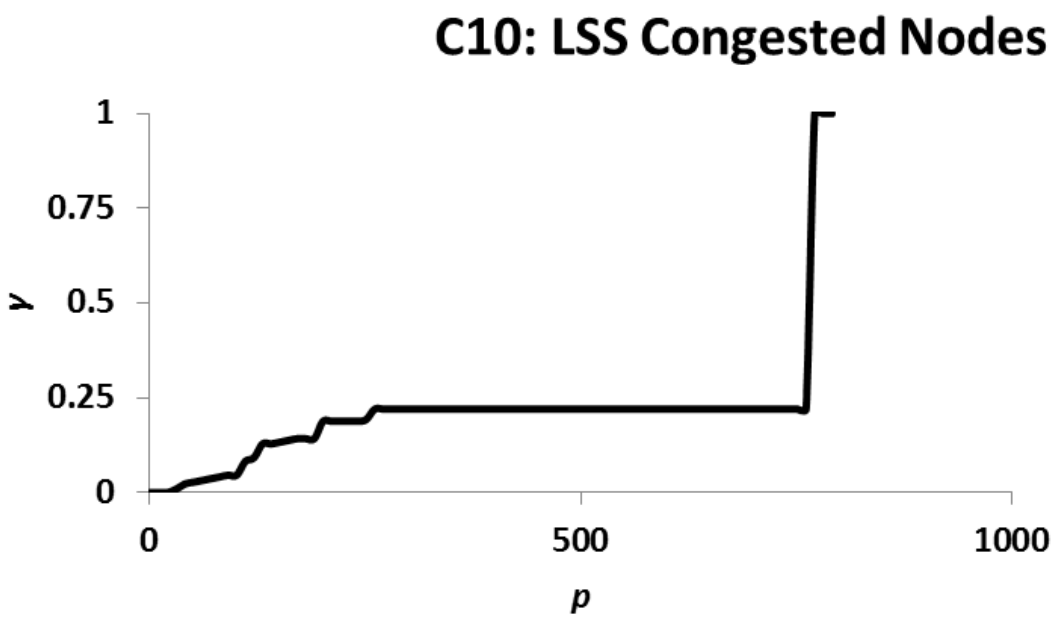

C1: LSS Congested Nodes
1
0.75
0.5
0.25
0
γ
0
500
1000
1500
2000
2500
p

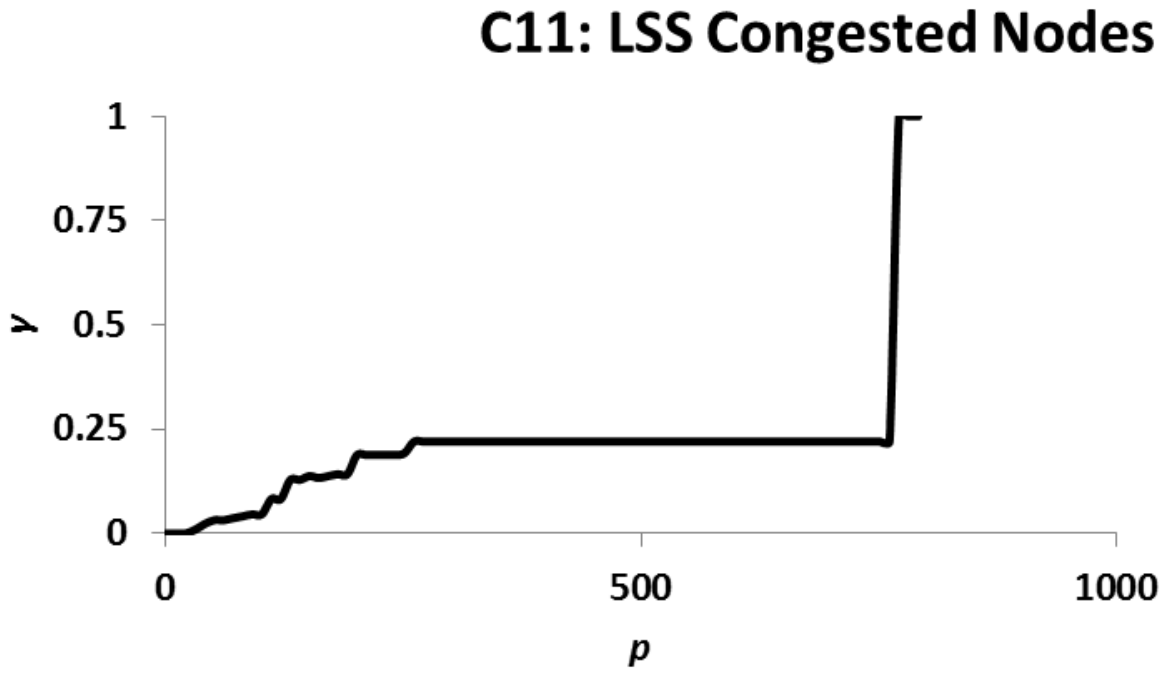

C2: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

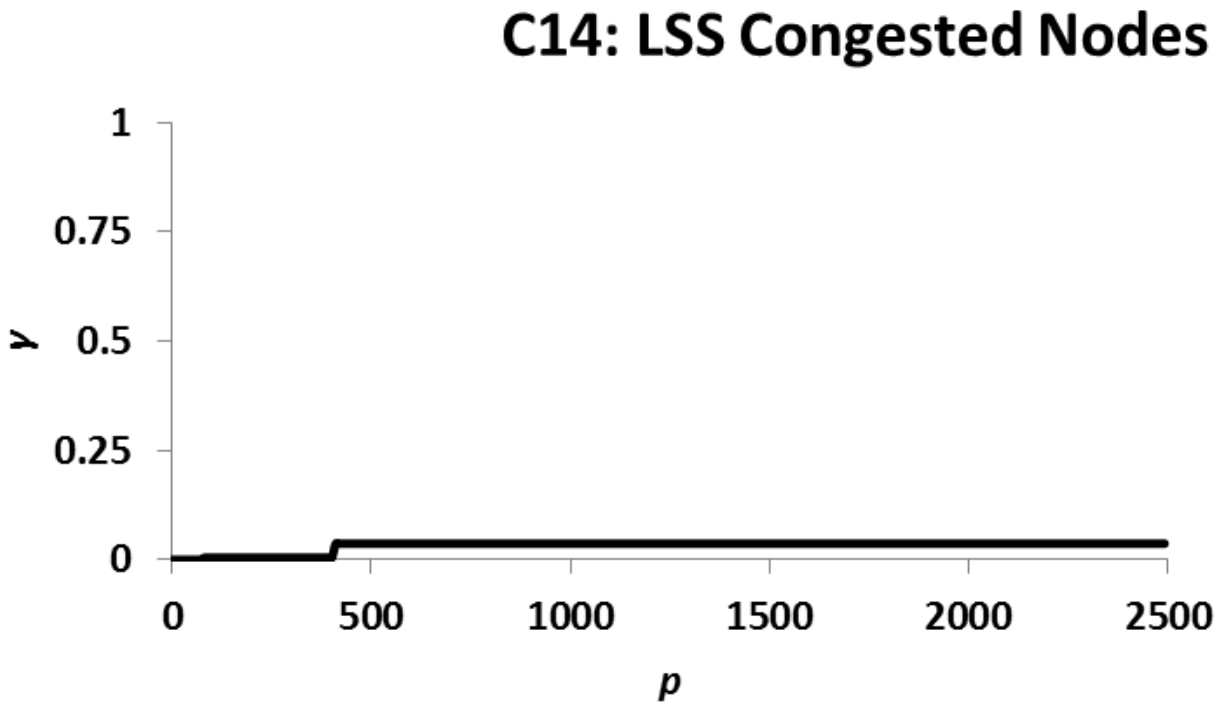

C3: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

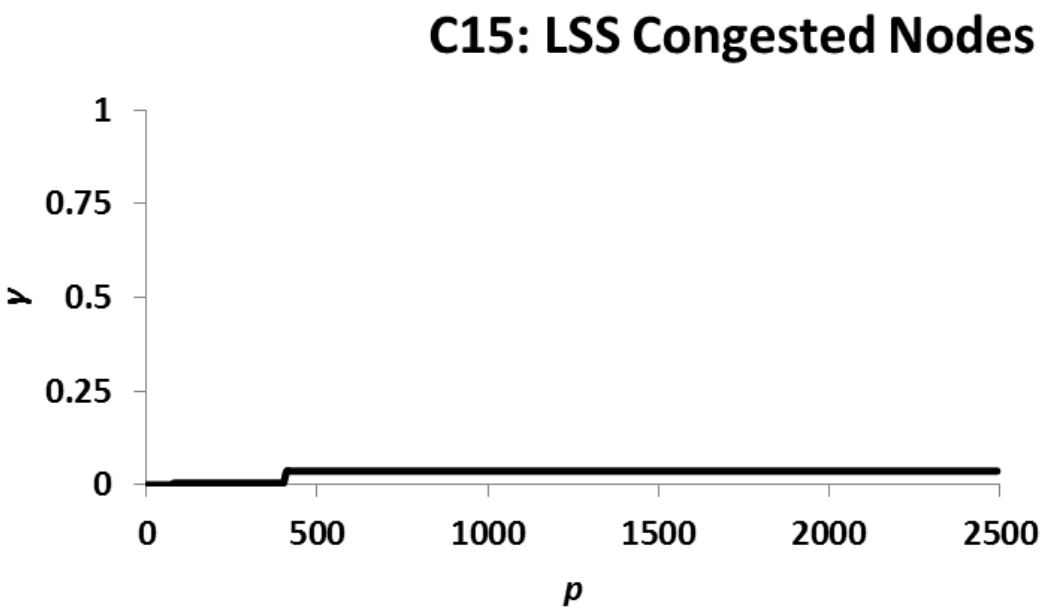

C6: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

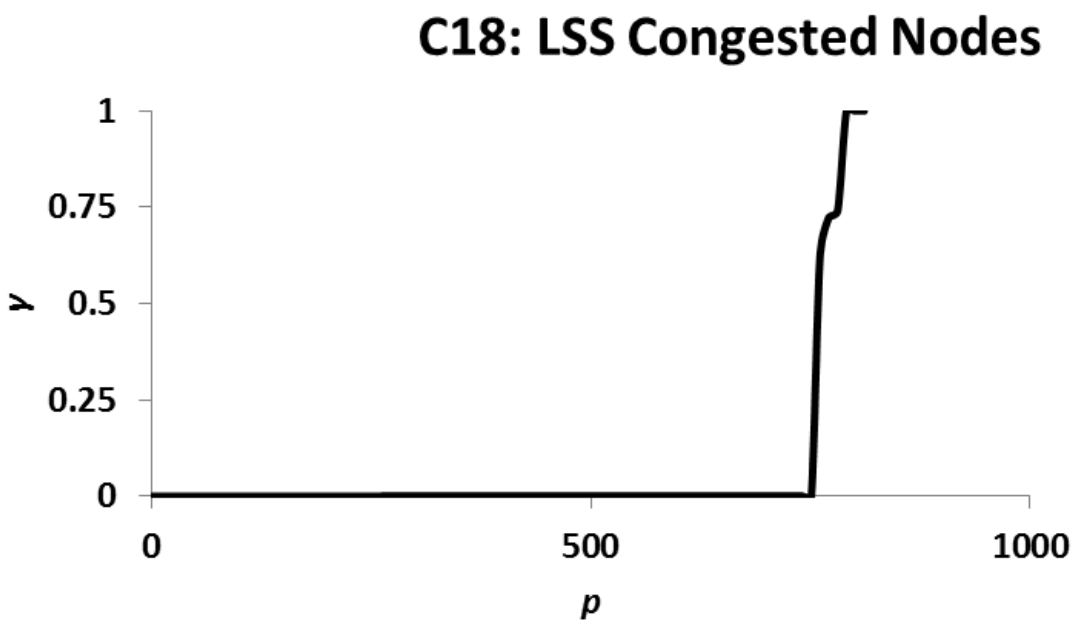

C7: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

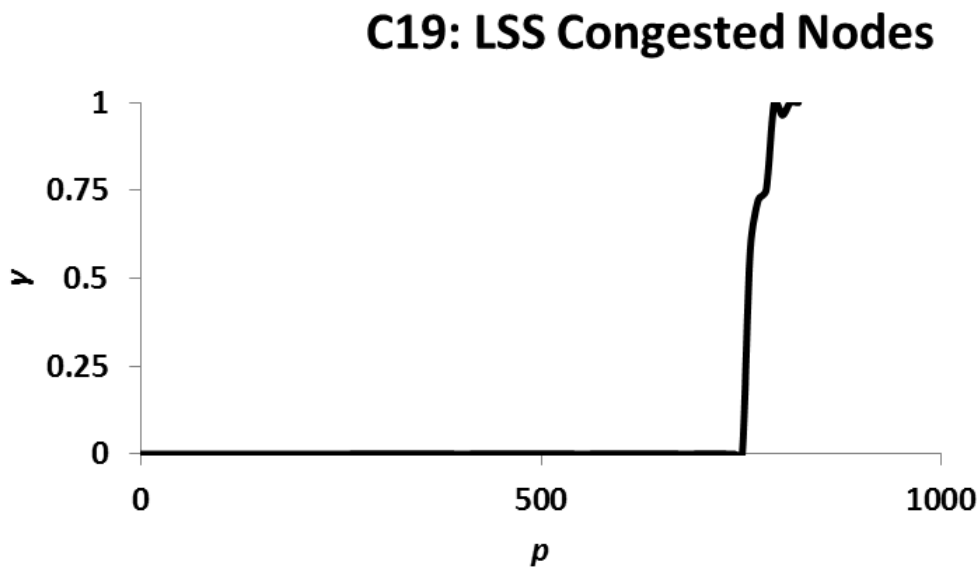

C10: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

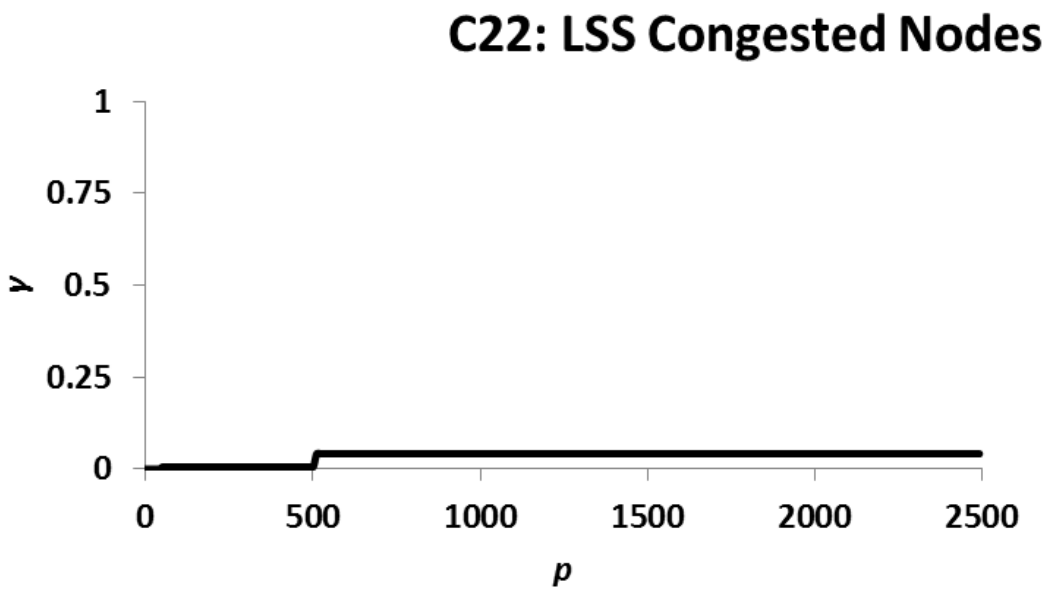

C11: LSS Congested Nodes
1
0.75
0.5
0.25
0
γ
0
500
1000
p

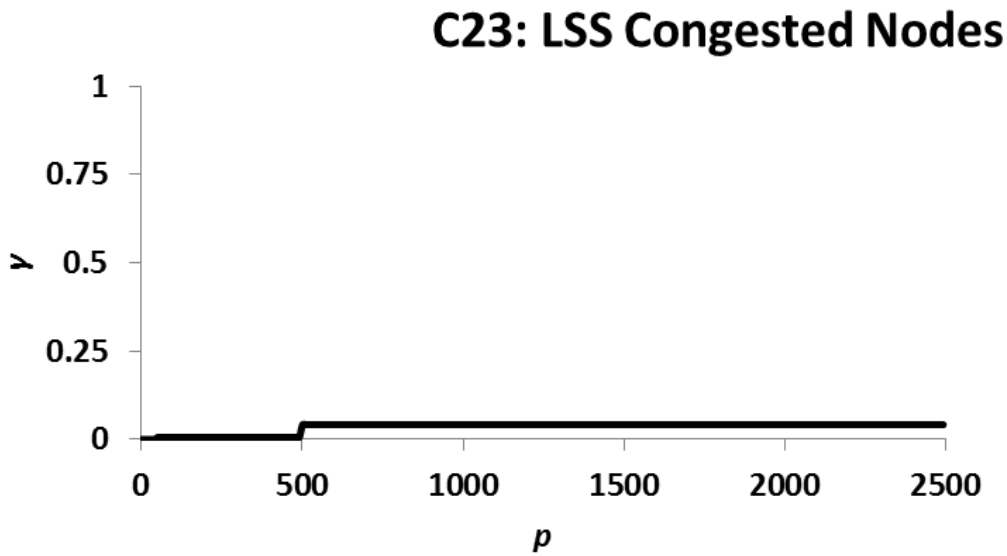

C14: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

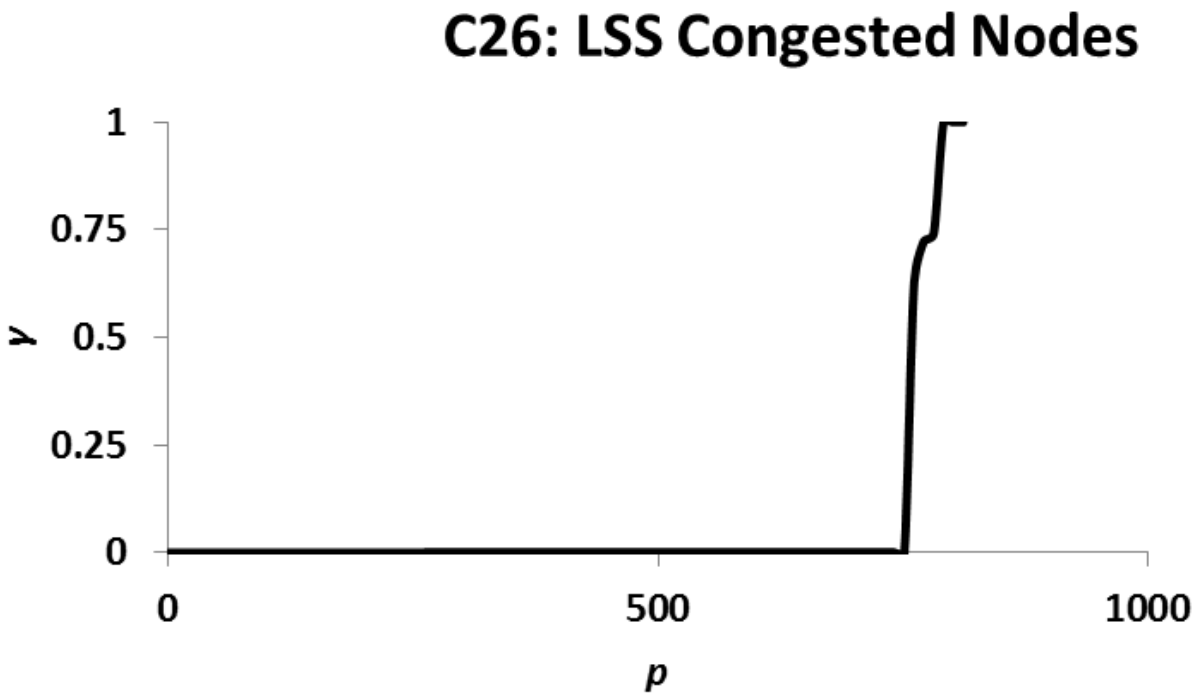

C15: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

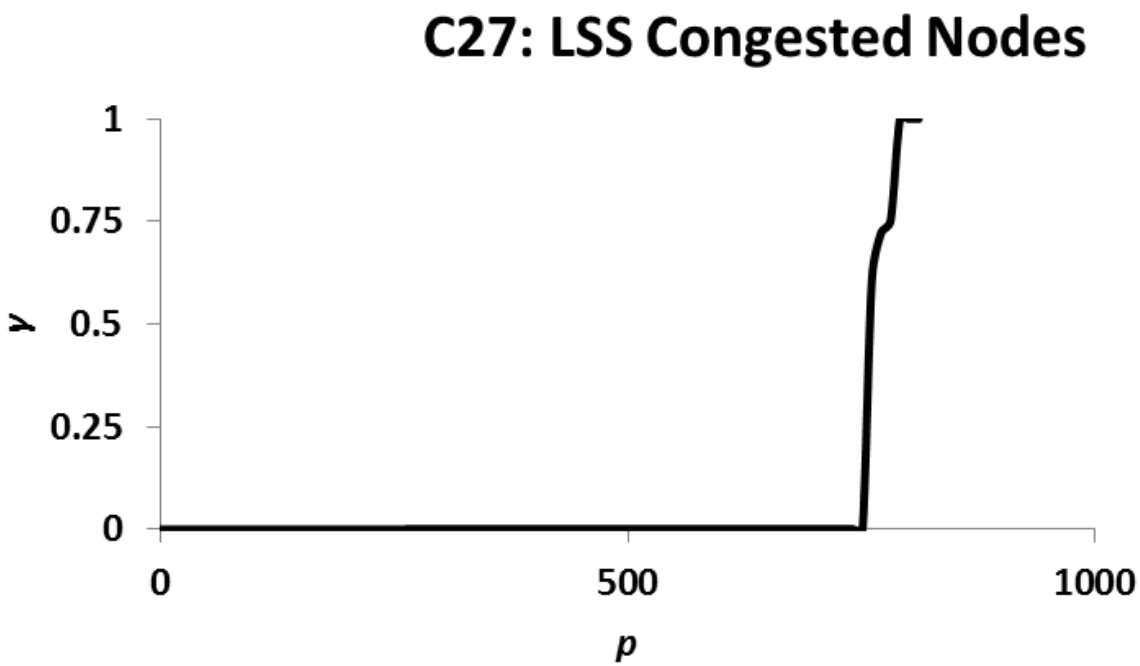

C18: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

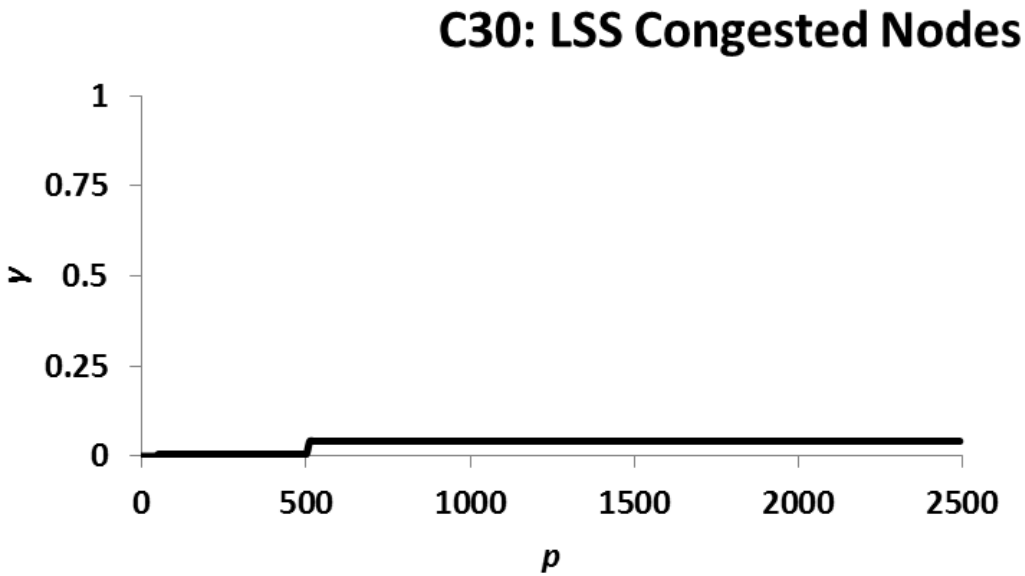

C19: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

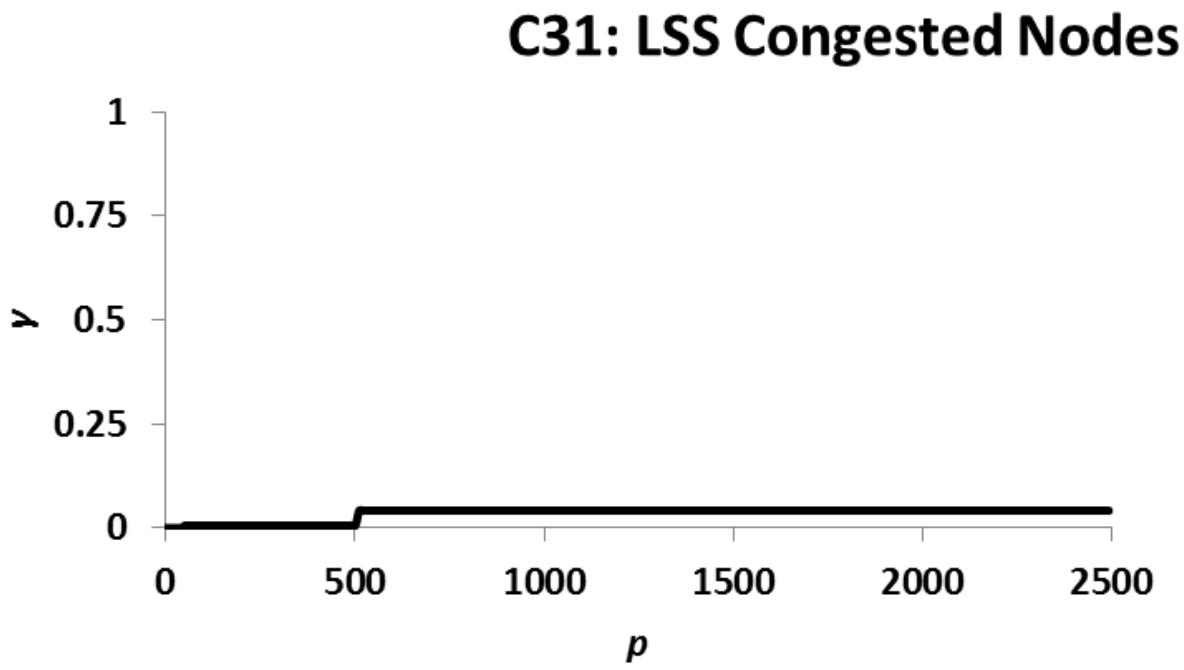

C22: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

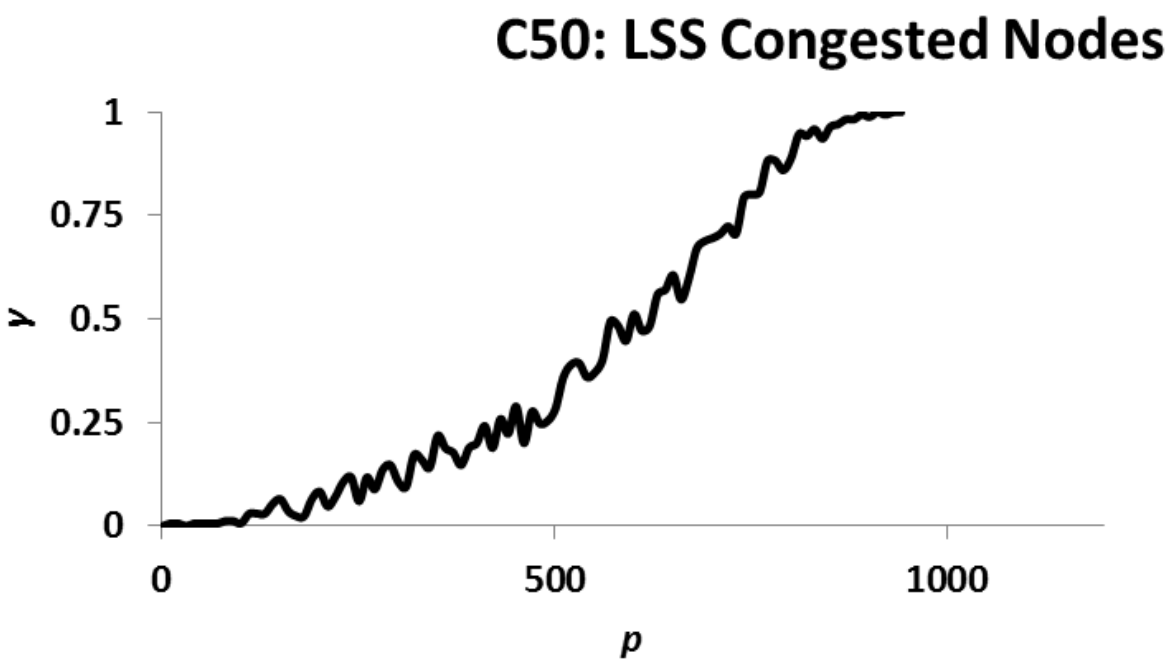

C23: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

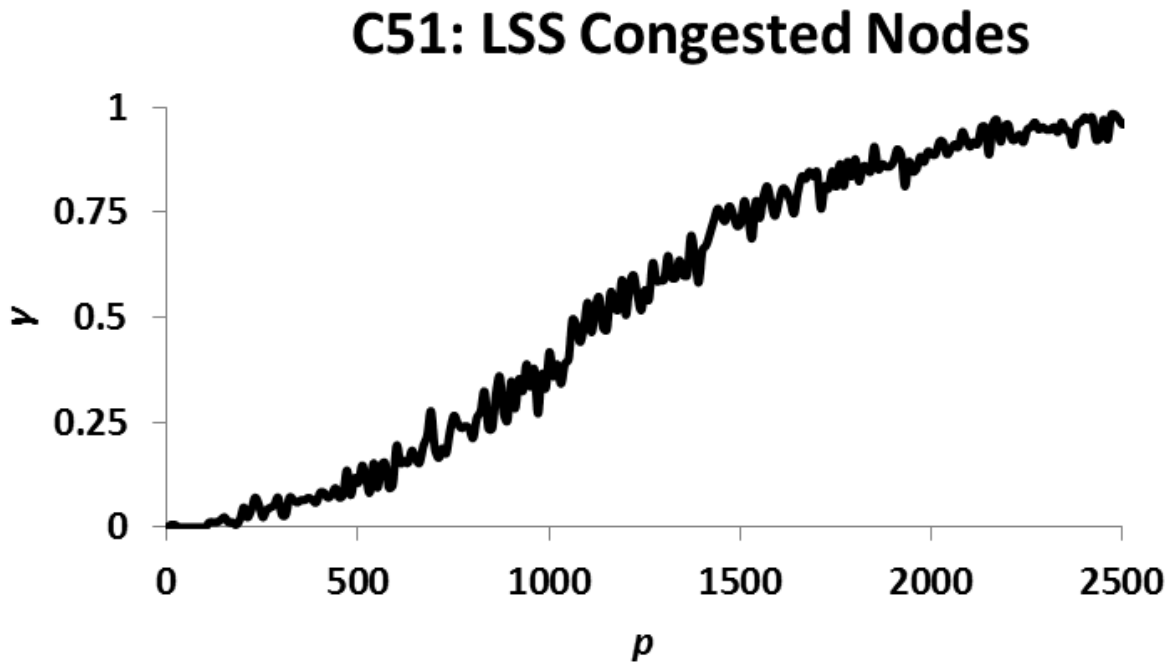

C26: LSS Congested Nodes
1
0.75
0.5
0.25
0
ν
0
500
1000
p

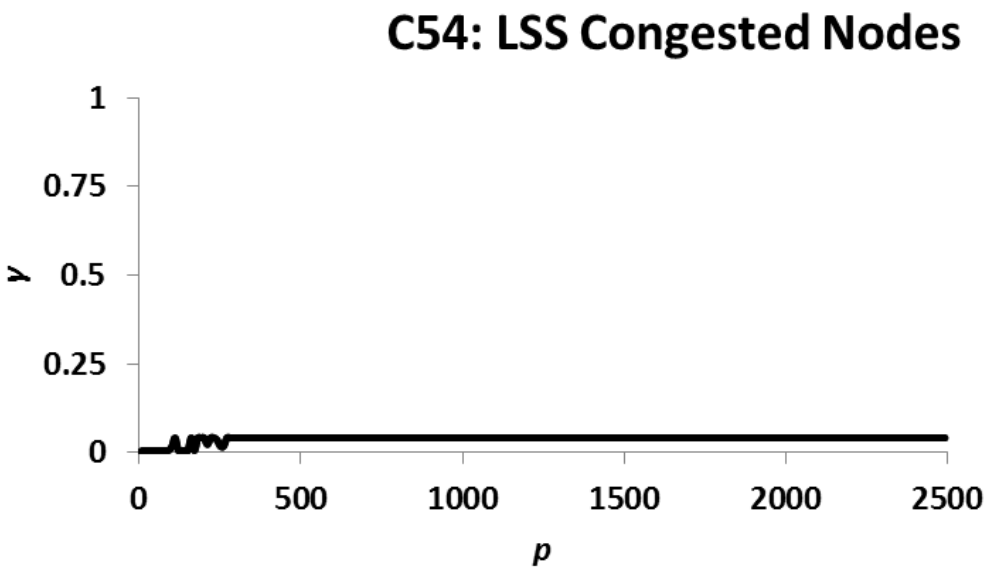

C27: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

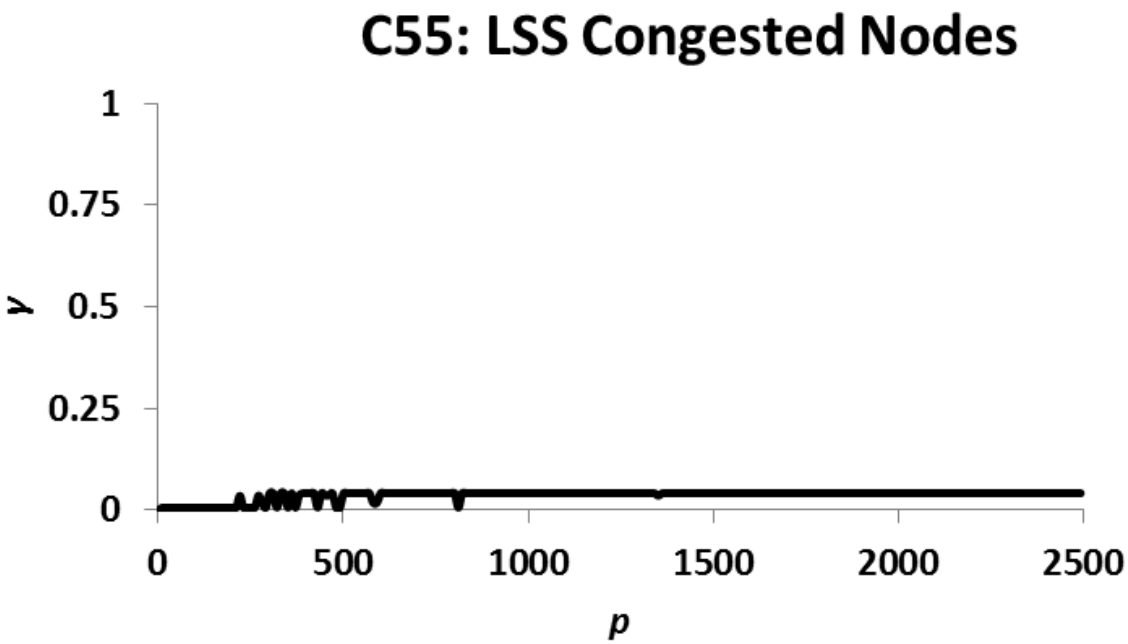

C30: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

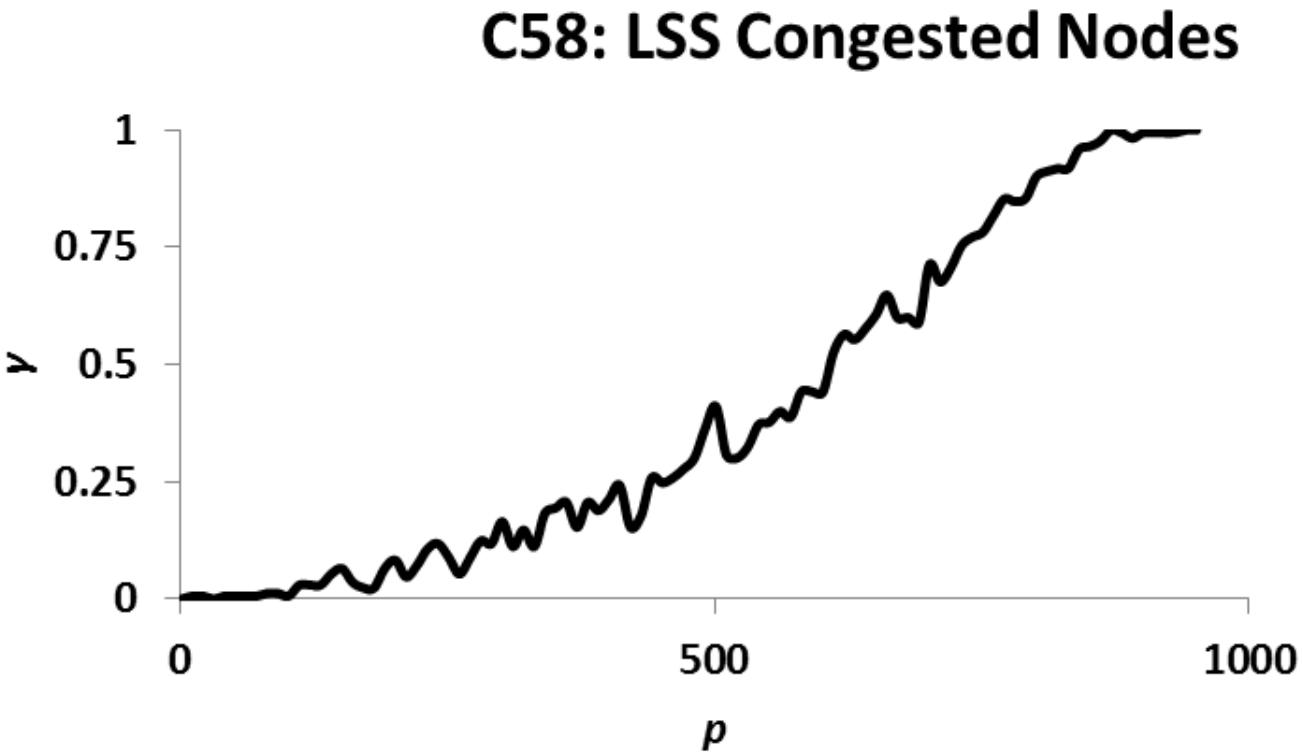

C31: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

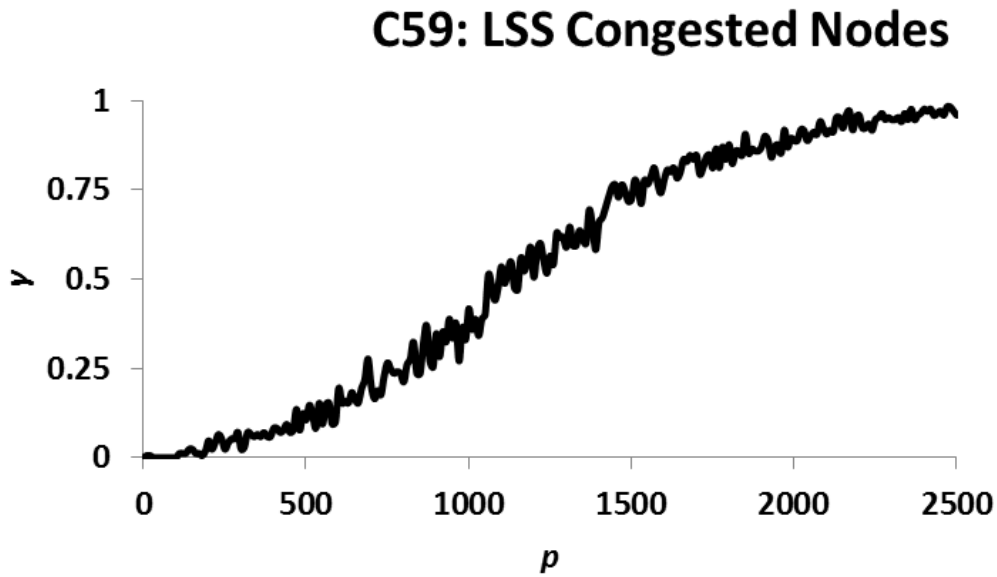

C50: LSS Congested Nodes
1
0.75
0.5
0.25
0
ν
0
500
1000
p

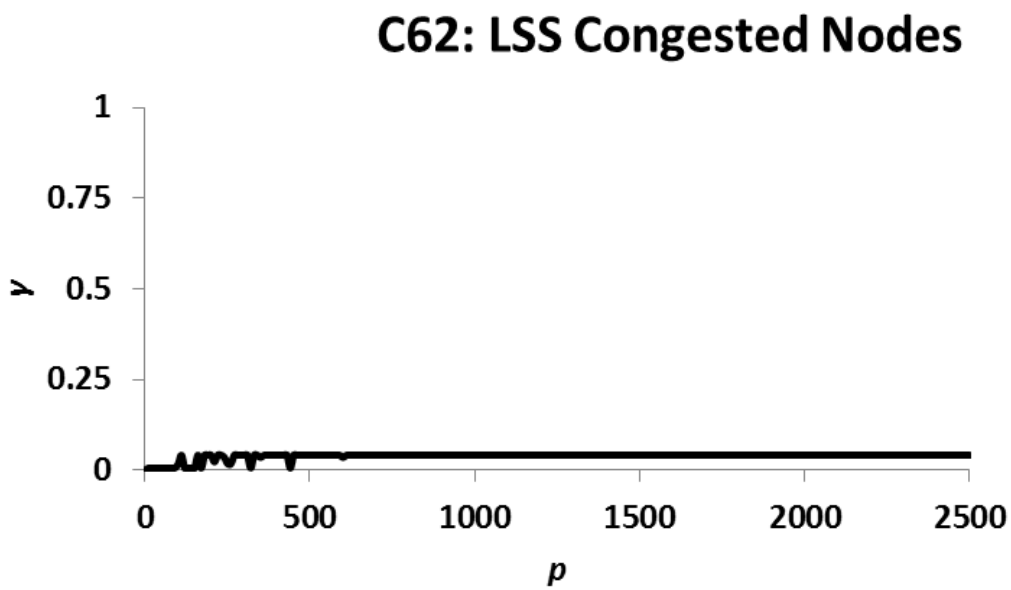

C51: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

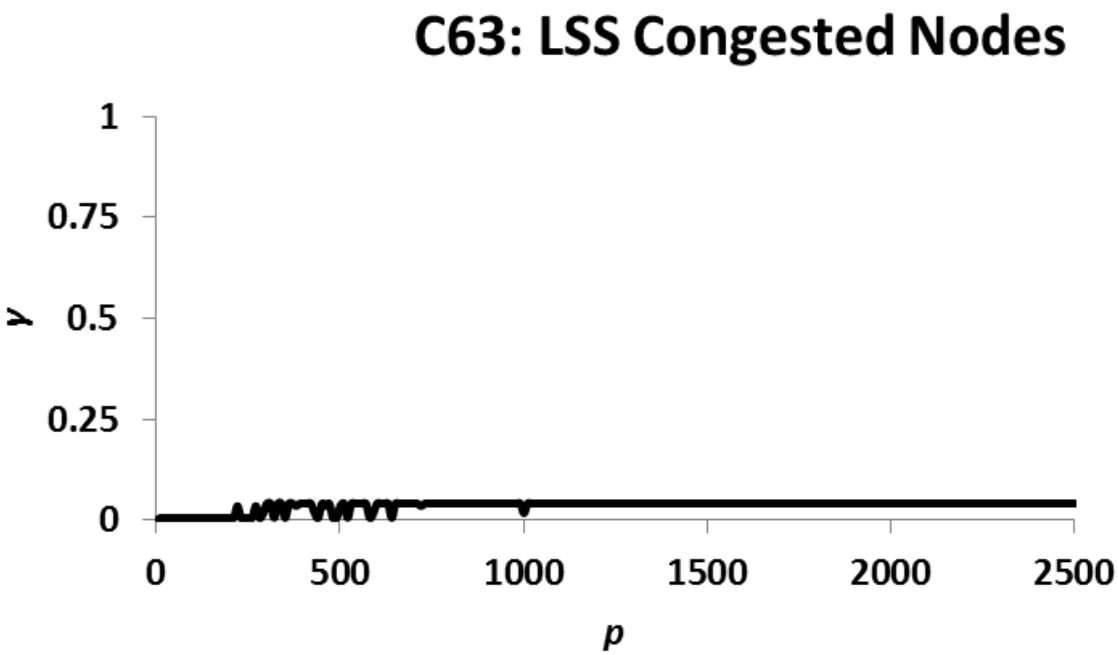

C54: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

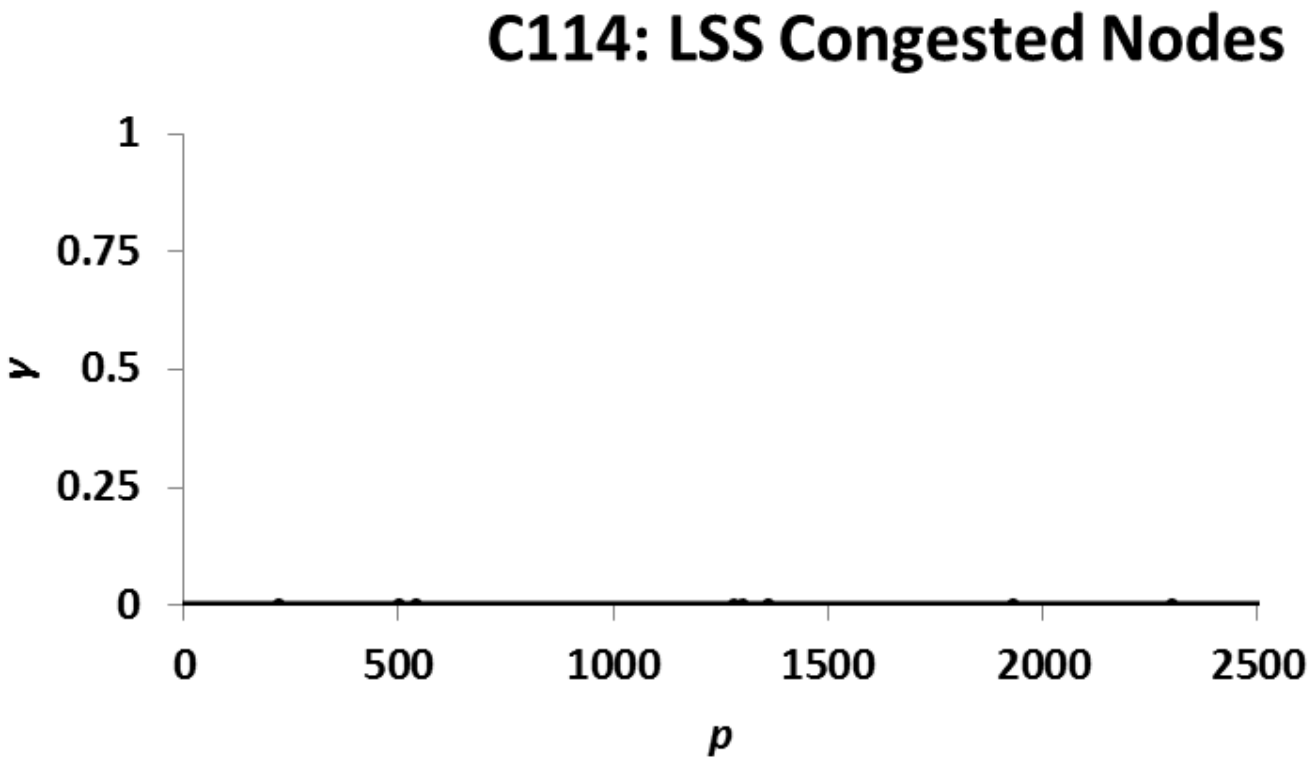

C55: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

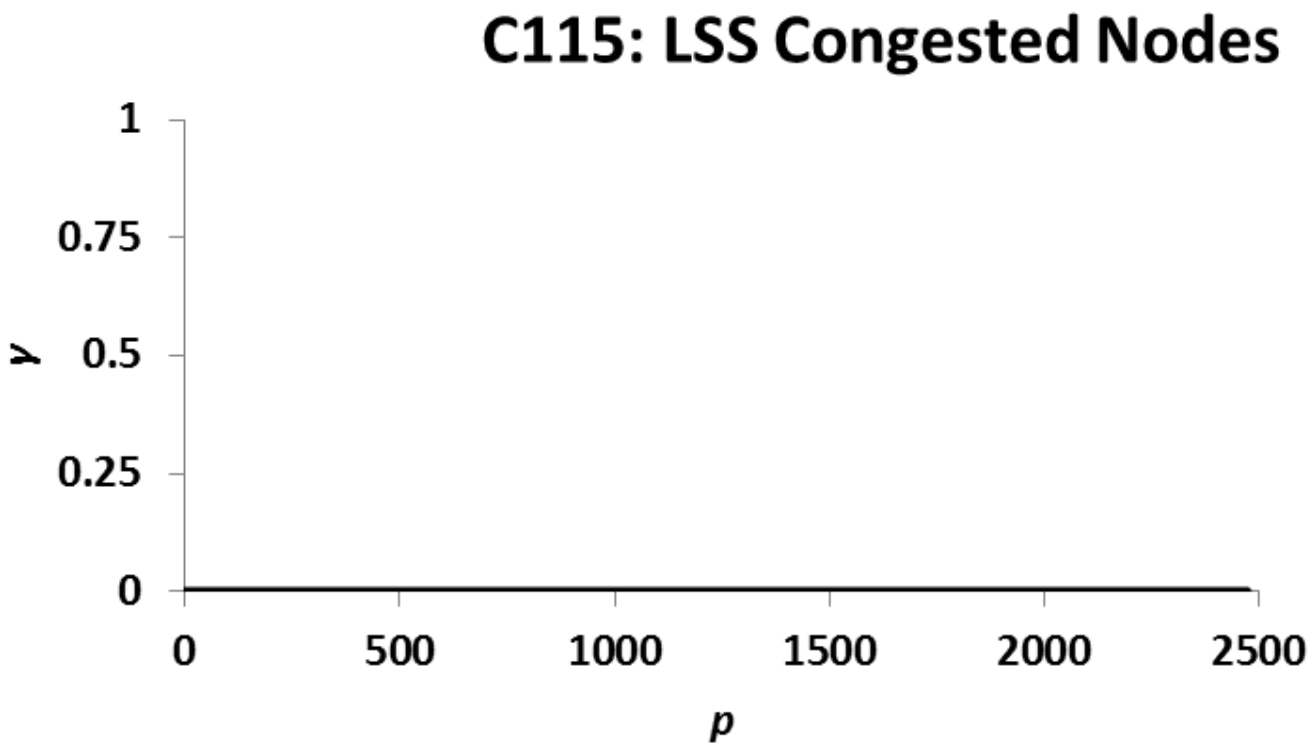

C58: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
p

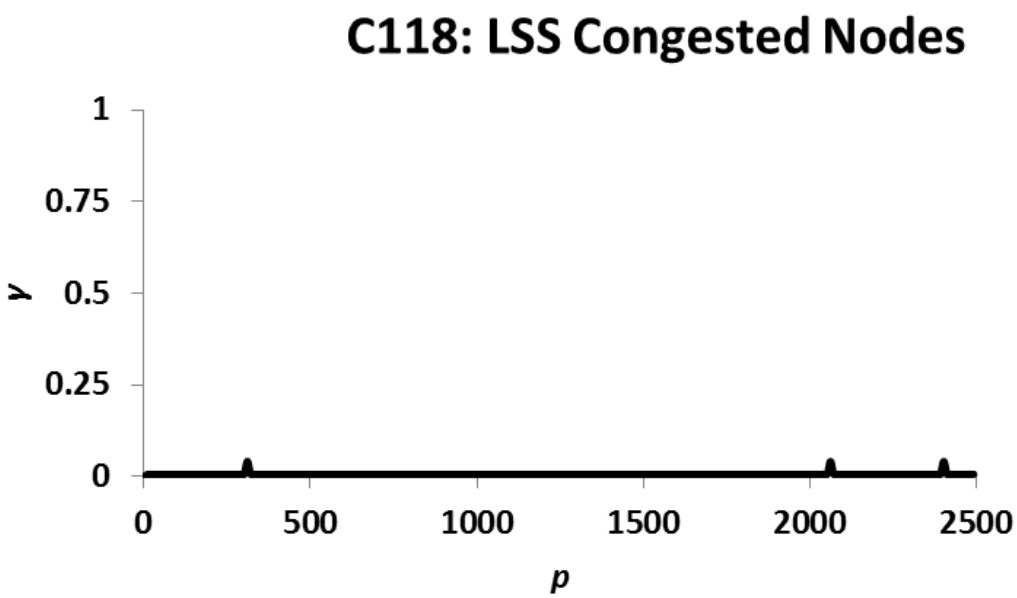

C59: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

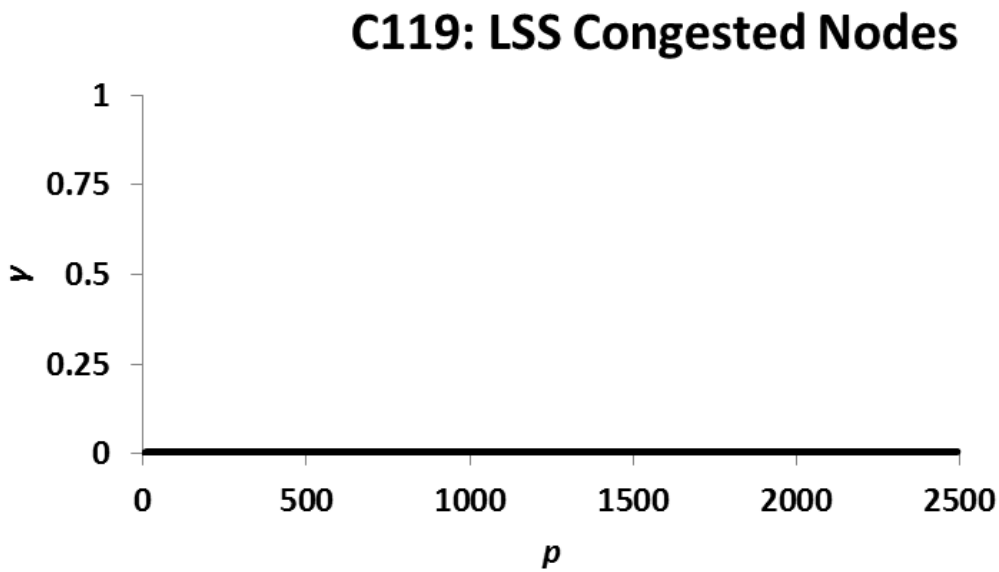

C62: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

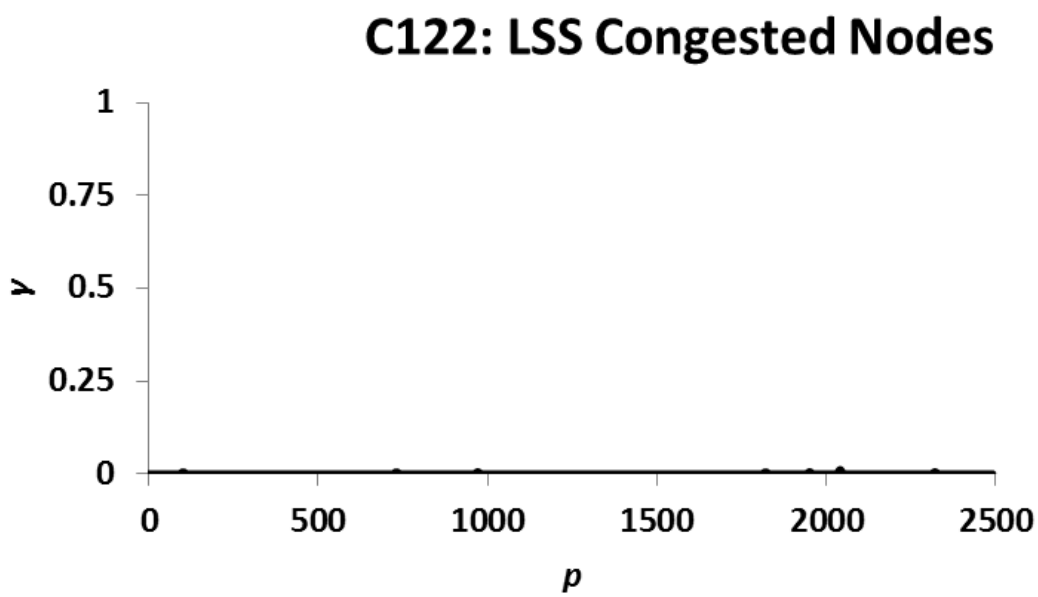

C63: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

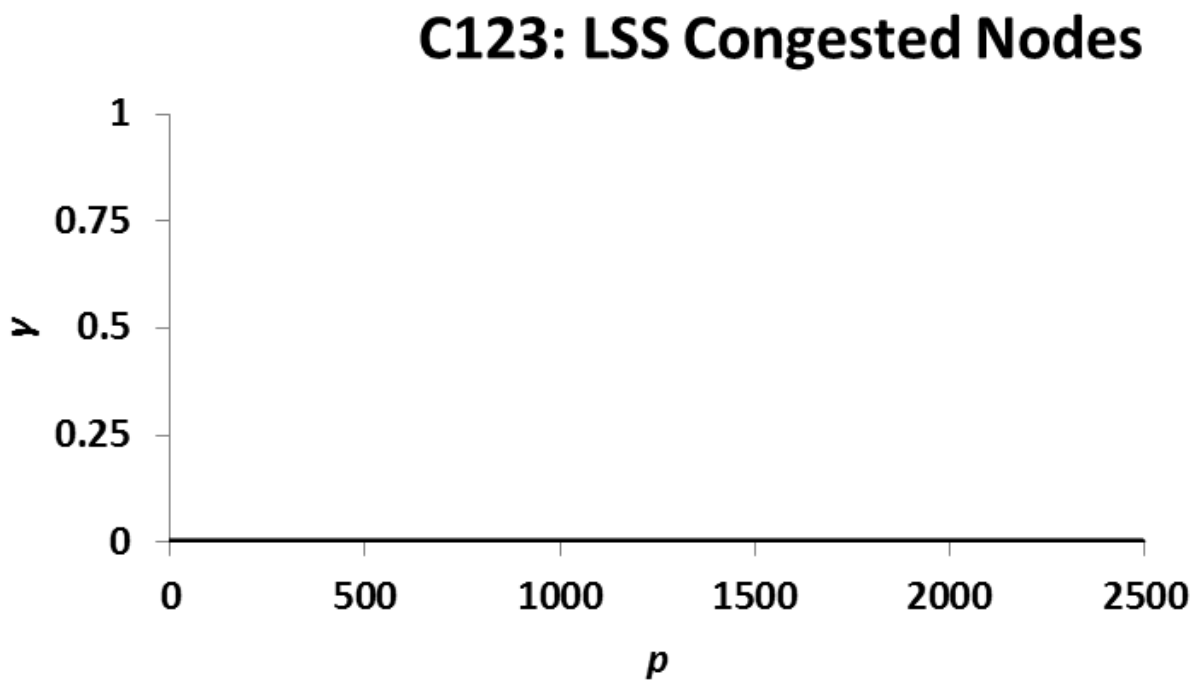

C114: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

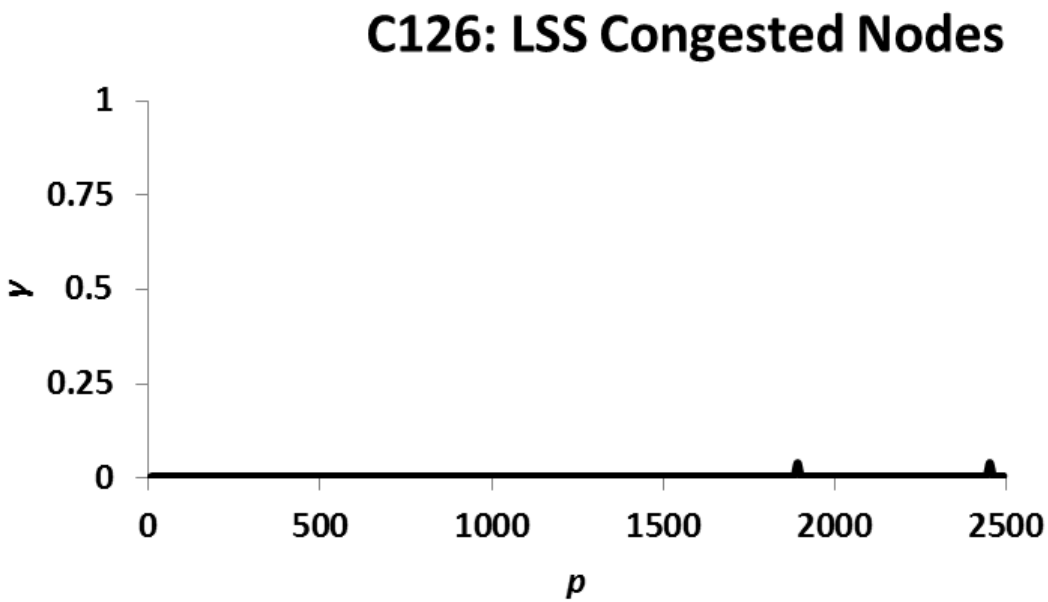

C115: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

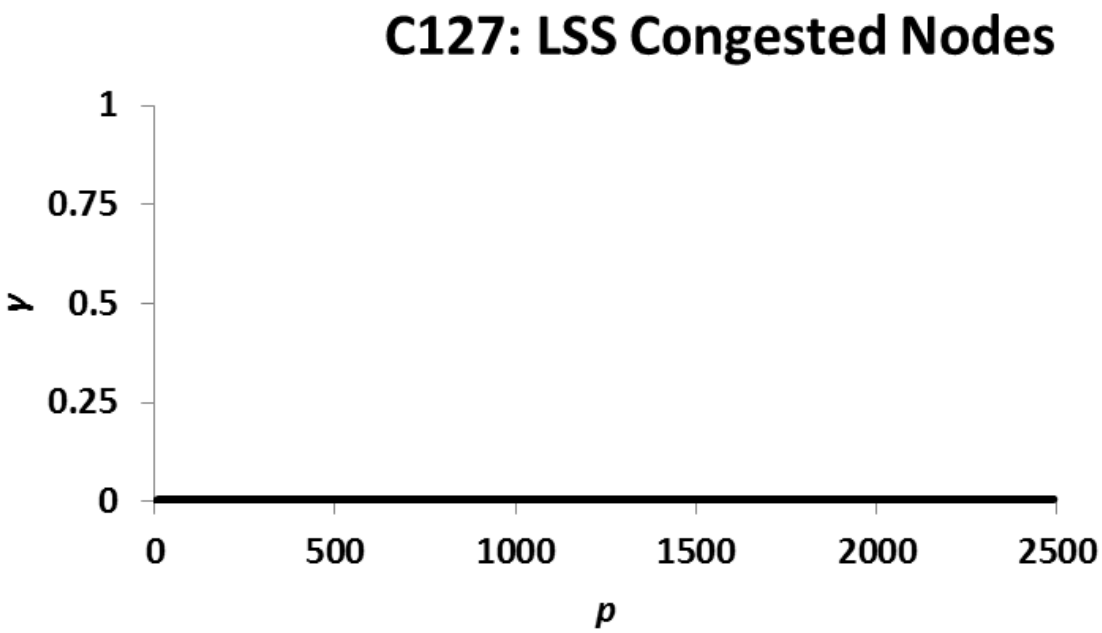

C118: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

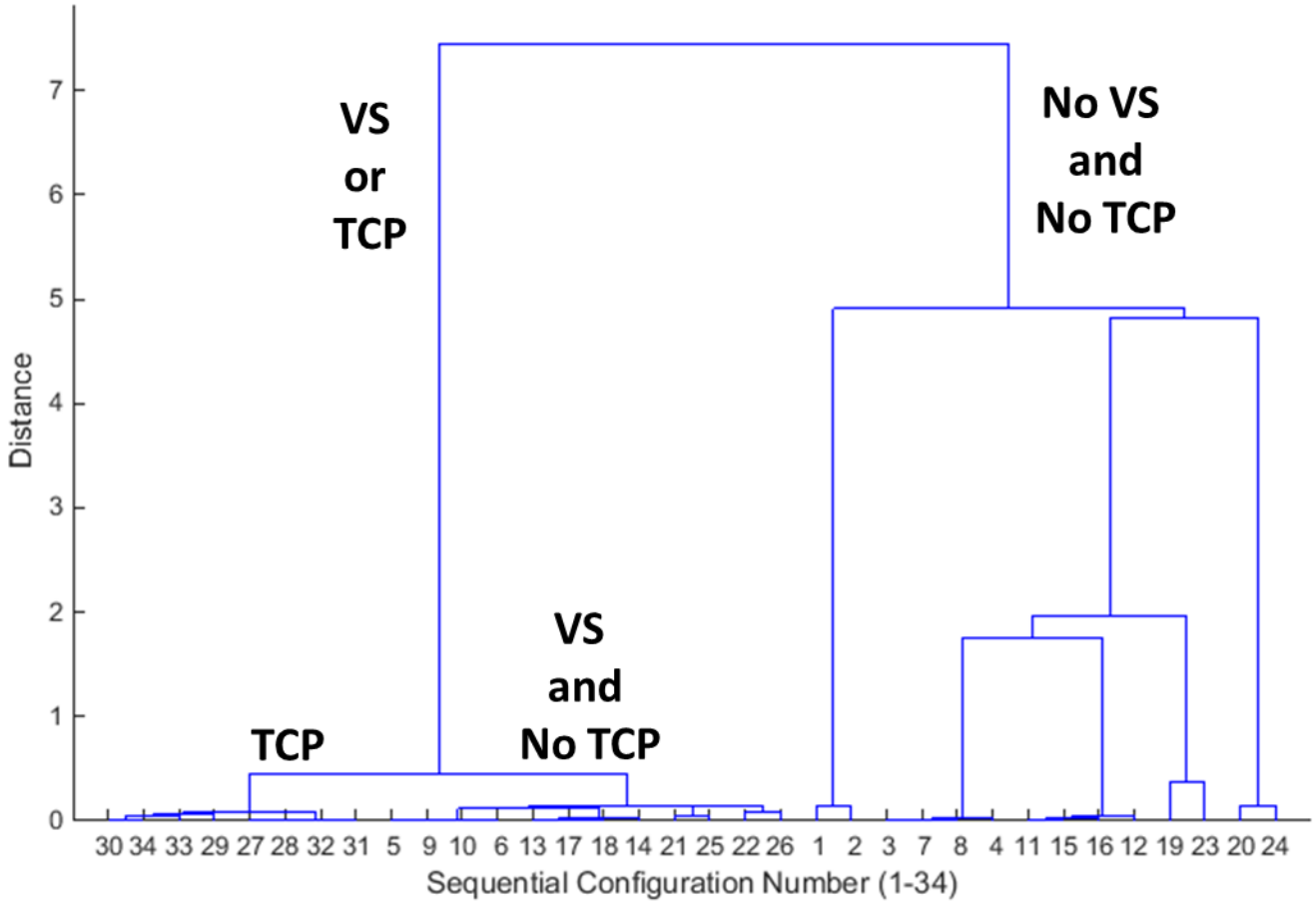

C119: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p


C122: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p


C123: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p


C126: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p


C127: LSS Congested Nodes
1
0.75
0.5
0.25
0
y
0
500
1000
1500
2000
2500
p

Clustering for Congested Nodes (*Y*) Figure A2
(Dabrowski & Mills NIST)

Hierarchical Clustering 2500 Series Congested Nodes (γ)