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ELE 459 Homework 4 Plotting

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Problem 1 (Heavy Traffic Validation)

See Probl.cpp for simulation code.

```
data = table2array(readtable('gg1_htv2'));

epsilon = data(:,1);
vals = data(:,2);

x = epsilon.^-1;

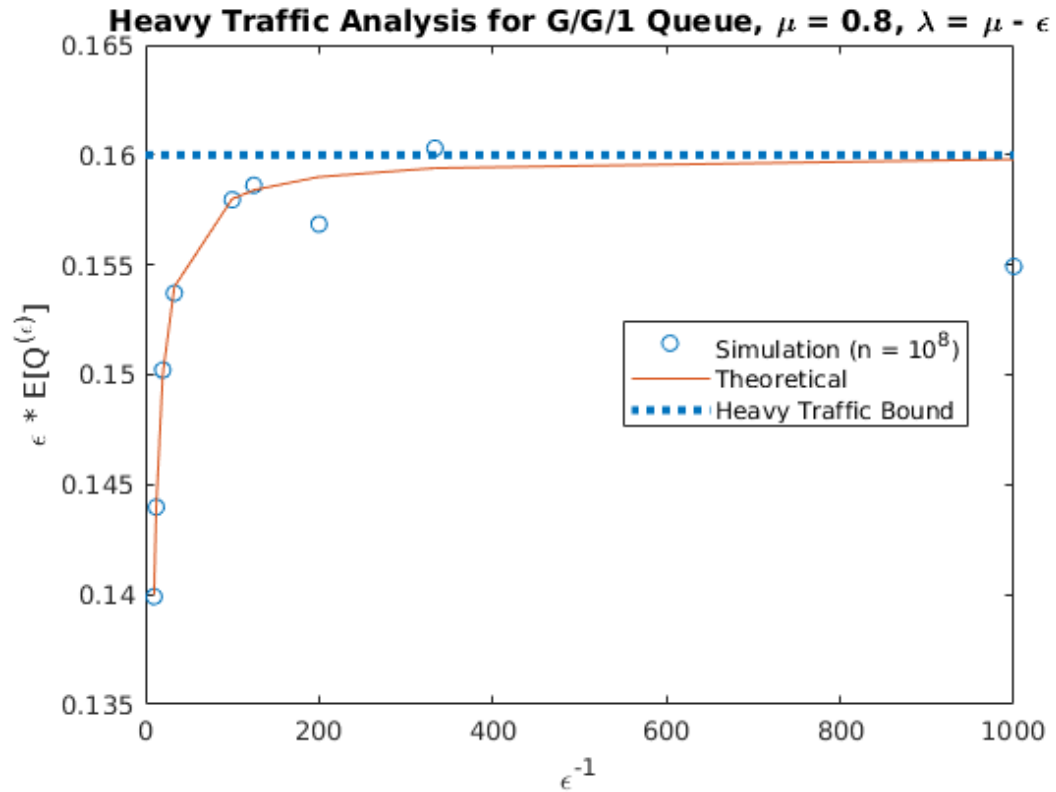
vals2 = epsilon.*vals;

mu = 0.8;
epsln = [0.1, 0.08, 0.05, 0.03, 0.01, 0.008, 0.005, 0.003, 0.001];
ExpQ = zeros;
i = 1;
for i = 1:9
    lambda = mu - epsln(i);
    roh = (lambda*(1-mu))/(mu*(1-lambda));
    ExpQ(i) = epsln(i)*(roh/(1-roh));
end

bound = mu*(1-mu);

plot(x, vals2, 'o')
xlabel('\epsilon^{-1}')
ylabel('\epsilon * E[Q^{\epsilon}]')
title('Heavy Traffic Analysis for G/G/1 Queue, \mu = 0.8, \lambda = \mu - \epsilon')
hold on
plot(x, ExpQ)
line([0 1000],[0.16 0.16], 'linewidth', 3, 'linestyle', ':');
legend('Simulation (n = 10^8)', 'Theoretical', 'Heavy Traffic Bound', 'Location', 'best')

hold off
```



Problem 2

```
clear; clc;

lambda = [0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.92, 0.94,
          0.96, 0.98, 0.99];
vals = linspace(0,20,21);

tailDistRR = zeros;
tailDistPow2C = zeros;
tailDistPow3C = zeros;
tailDistPow5C = zeros;

meanDelayRR = zeros;
meanDelayPow2C = zeros;
meanDelayPow3C = zeros;
meanDelayPow5C = zeros;

for j = 1:14
    for i = 1:21
        tailDistRR(i) = lambda(j)^i;
        tailDistPow2C(i) = lambda(j)^((2*i-1)/(2-1));
        tailDistPow3C(i) = lambda(j)^((3*i-1)/(3-1));
        tailDistPow5C(i) = lambda(j)^((5*i-1)/(5-1));
    end
end
```

```

meanDelayRR(j) = 1/(1 - lambda(j));

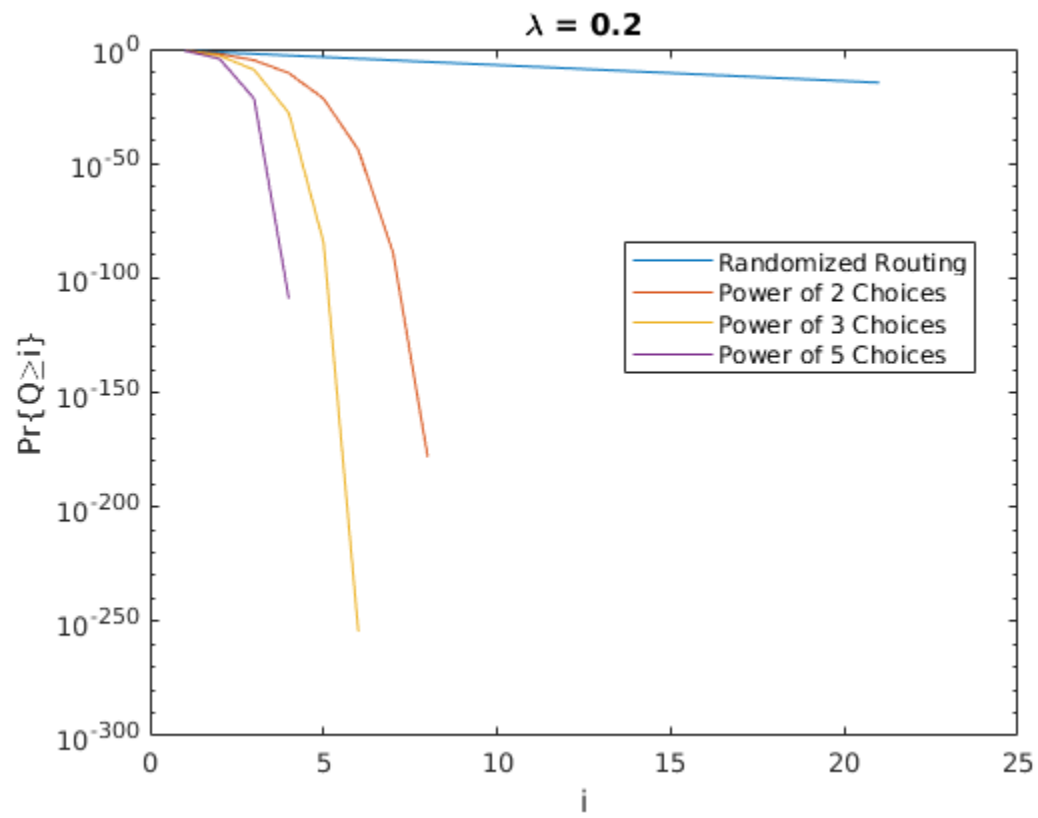
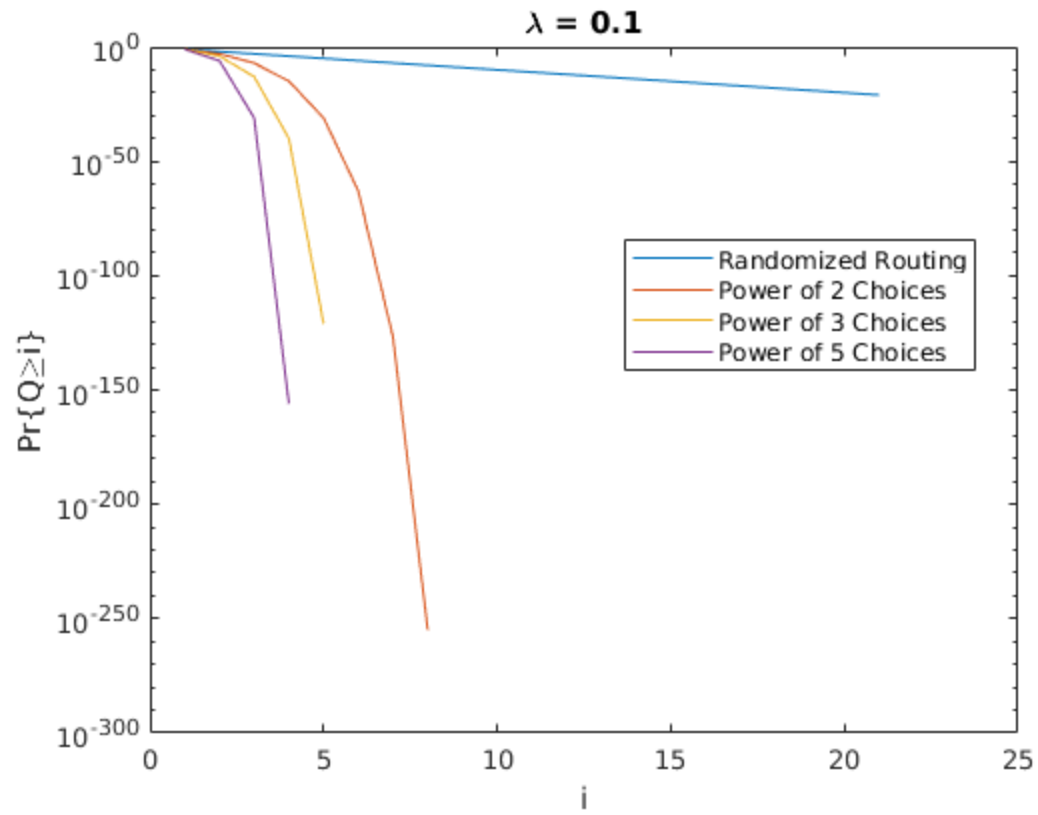
meanDelayPow2C(j) = sum(tailDistPow2C)/lambda(j);
meanDelayPow3C(j) = sum(tailDistPow3C)/lambda(j);
meanDelayPow5C(j) = sum(tailDistPow5C)/lambda(j);

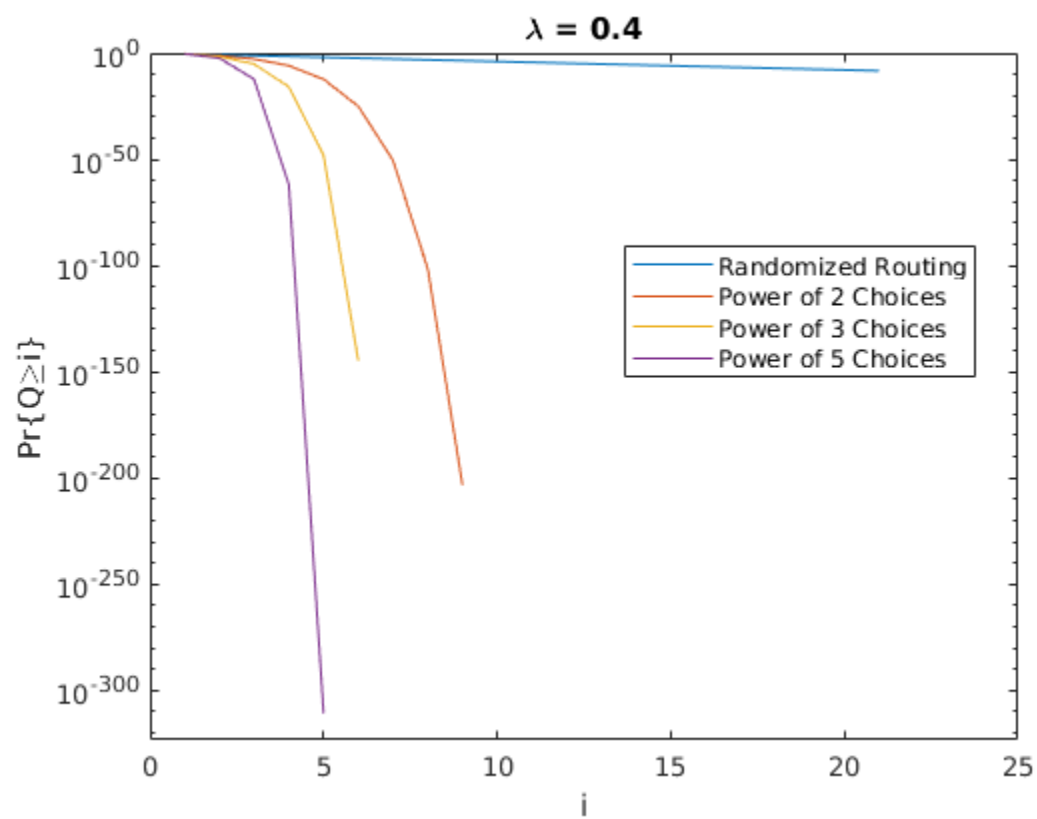
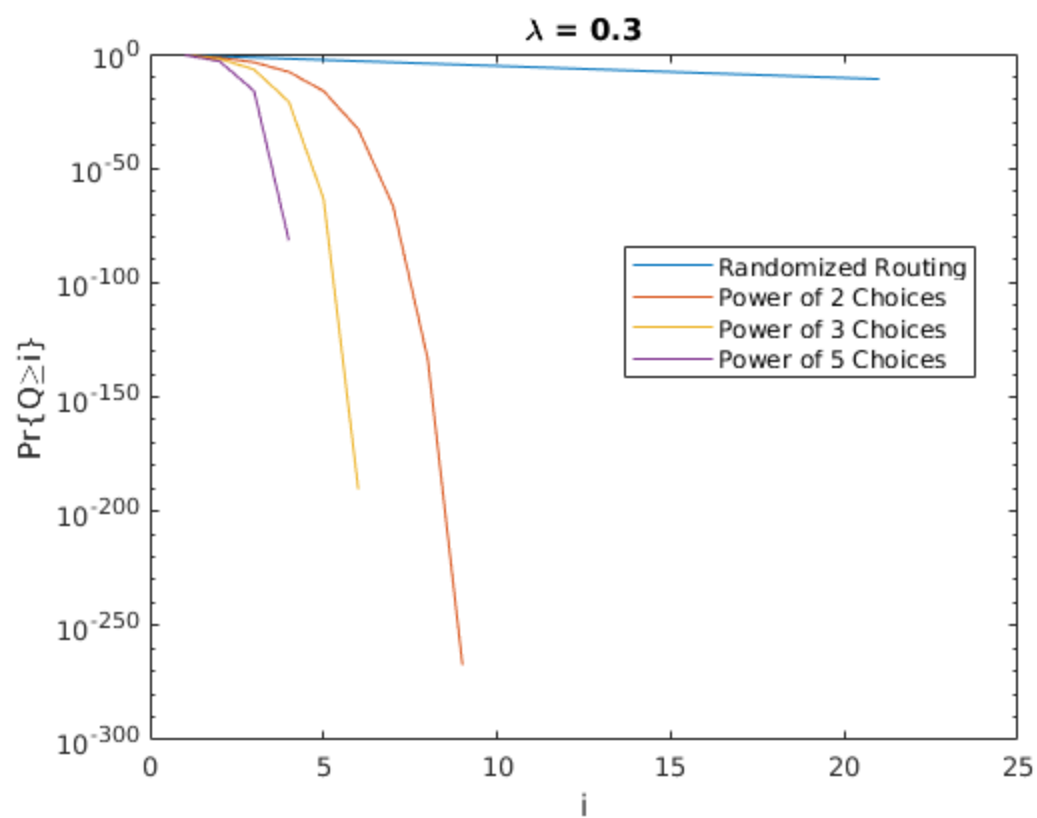
figure
semilogy(tailDistRR)
xlabel('i')
ylabel('Pr\{Q\geq i\}')
title(['\lambda = ', num2str(lambda(j))])
hold on
semilogy(tailDistPow2C)
semilogy(tailDistPow3C)
semilogy(tailDistPow5C)
legend('Randomized Routing','Power of 2 Choices','Power of 3
Choices','Power of 5 Choices','Location','best')

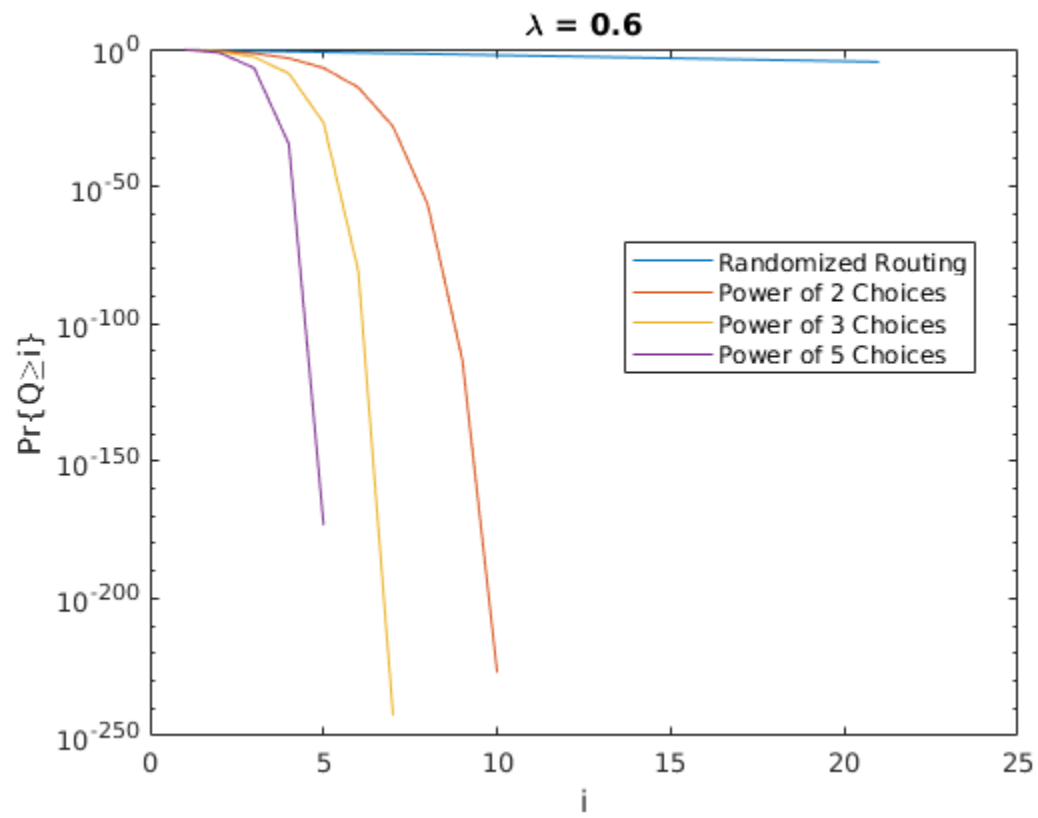
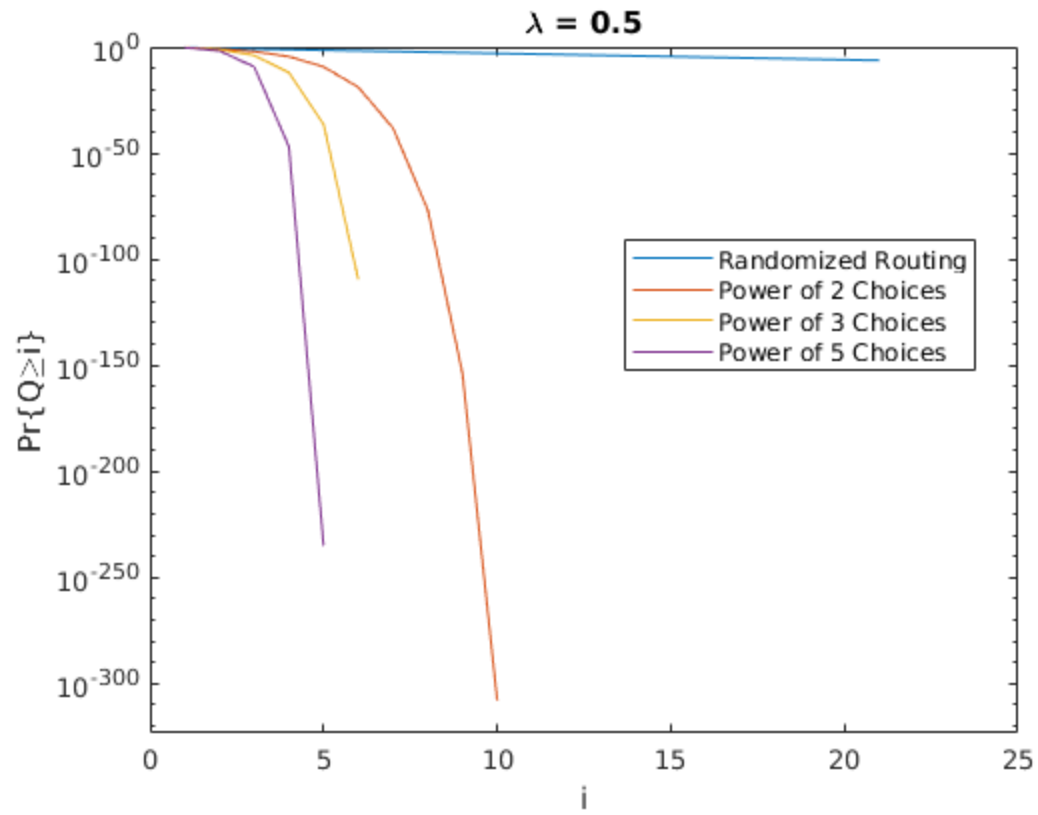
end
figure
plot(lambda,meanDelayRR)
hold on
plot(lambda,meanDelayPow2C)
plot(lambda,meanDelayPow3C)
plot(lambda,meanDelayPow5C)
xlabel('\lambda')
ylabel('Mean Delay')
title('E[W] vs \lambda')
legend('Randomized Routing','Power of 2 Choices','Power of 3
Choices','Power of 5 Choices','Location','best')

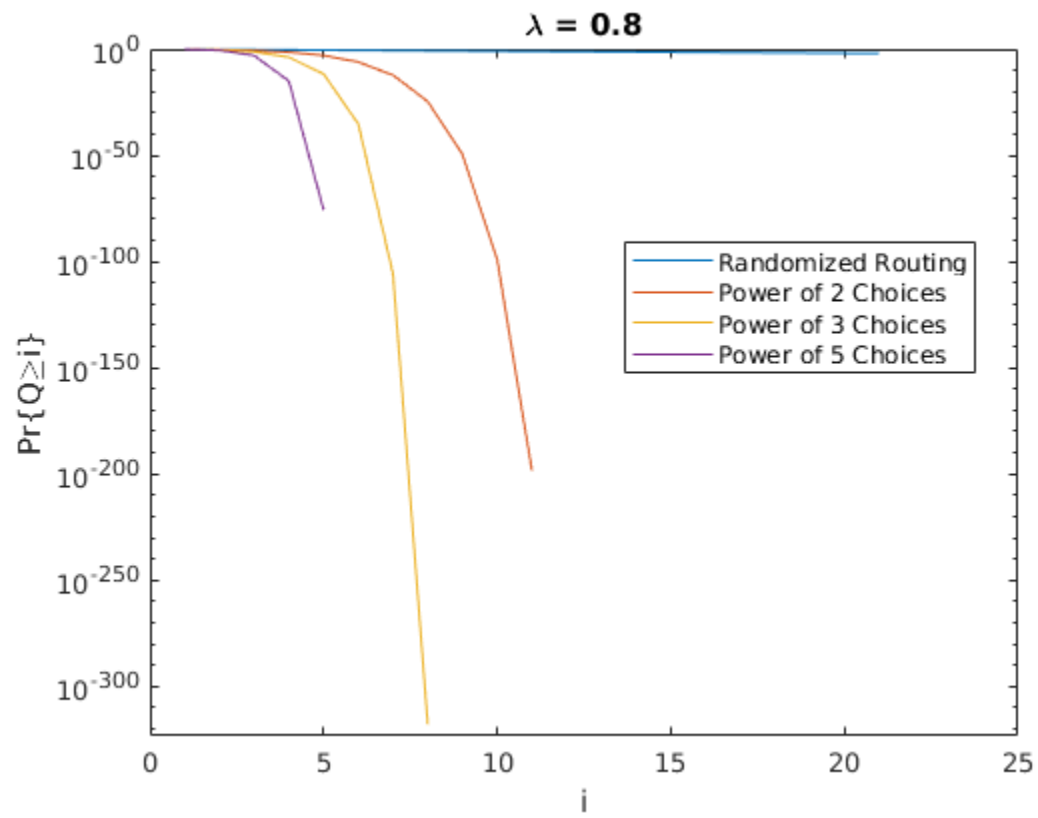
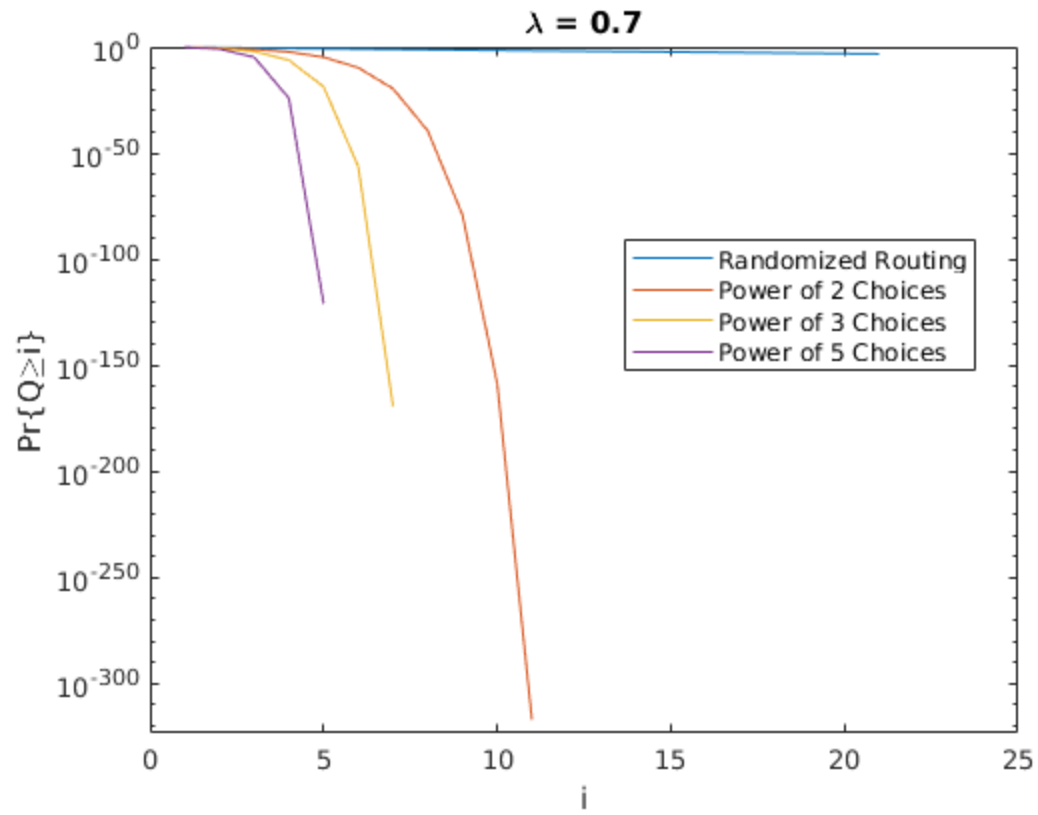
hold off

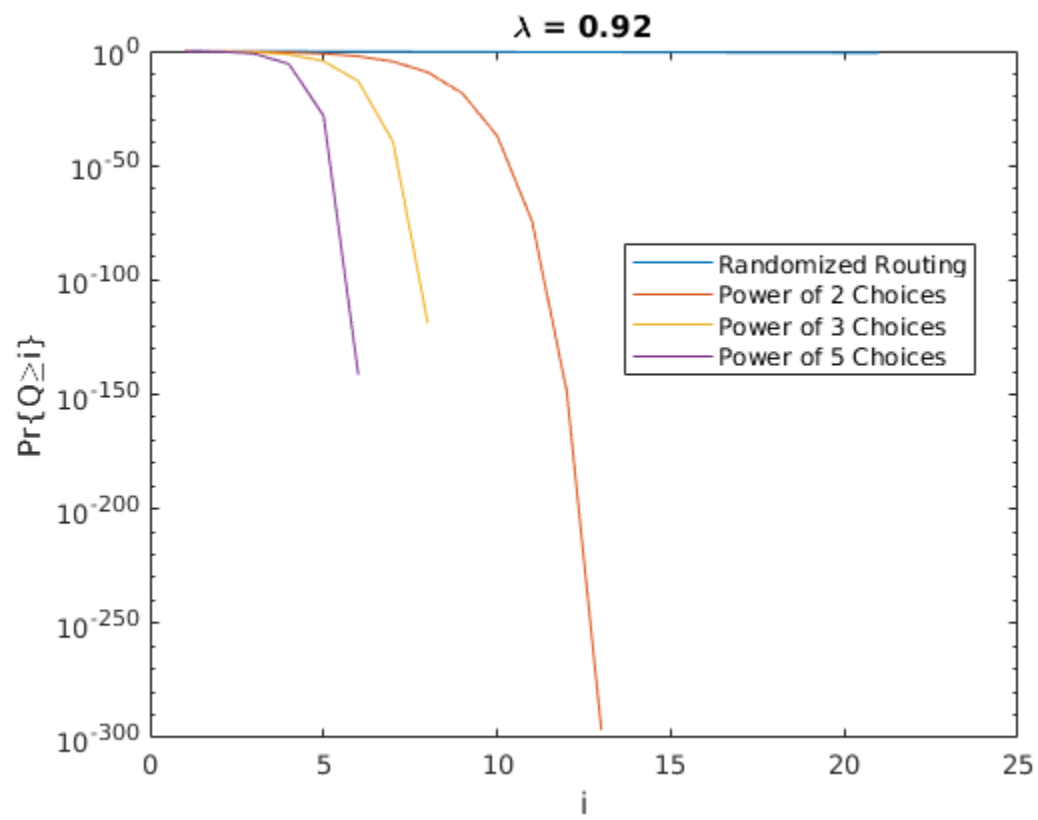
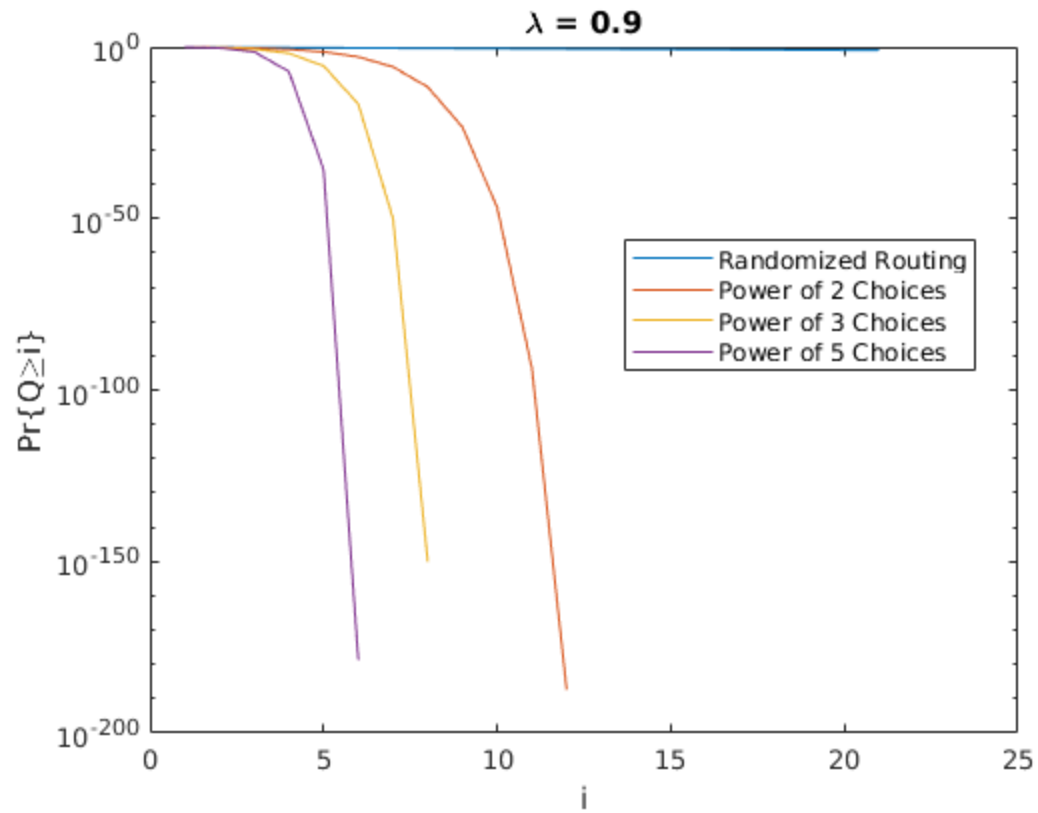
```

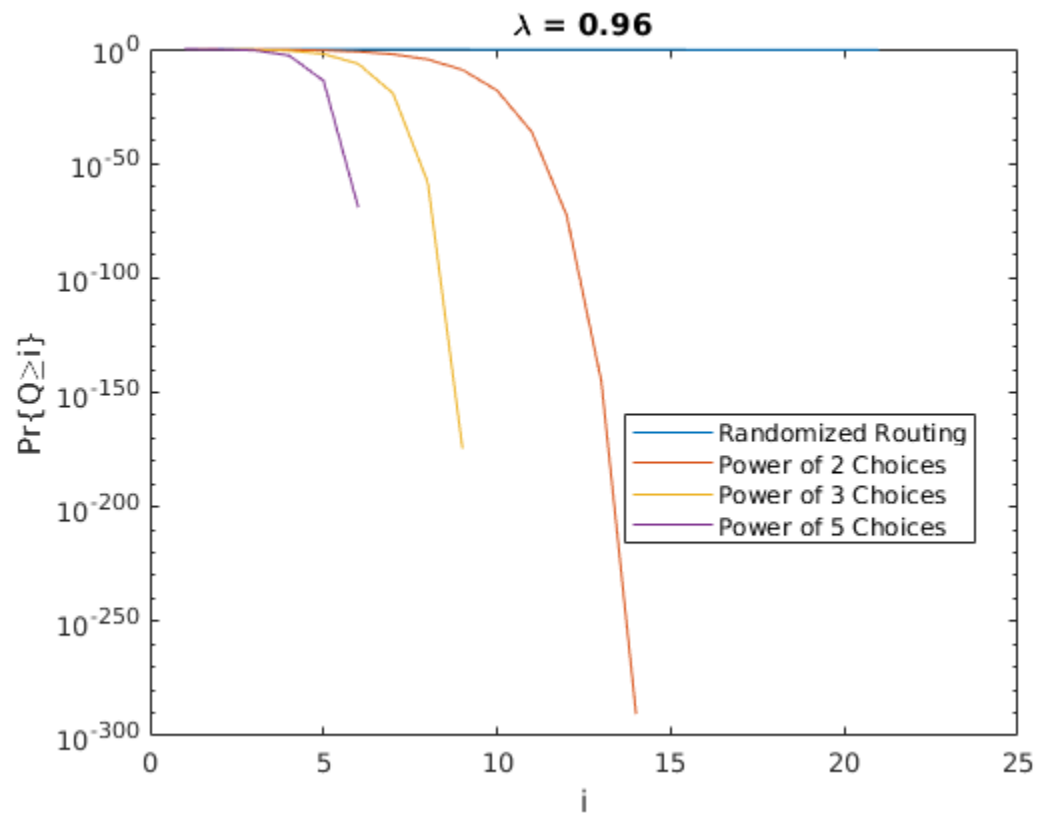
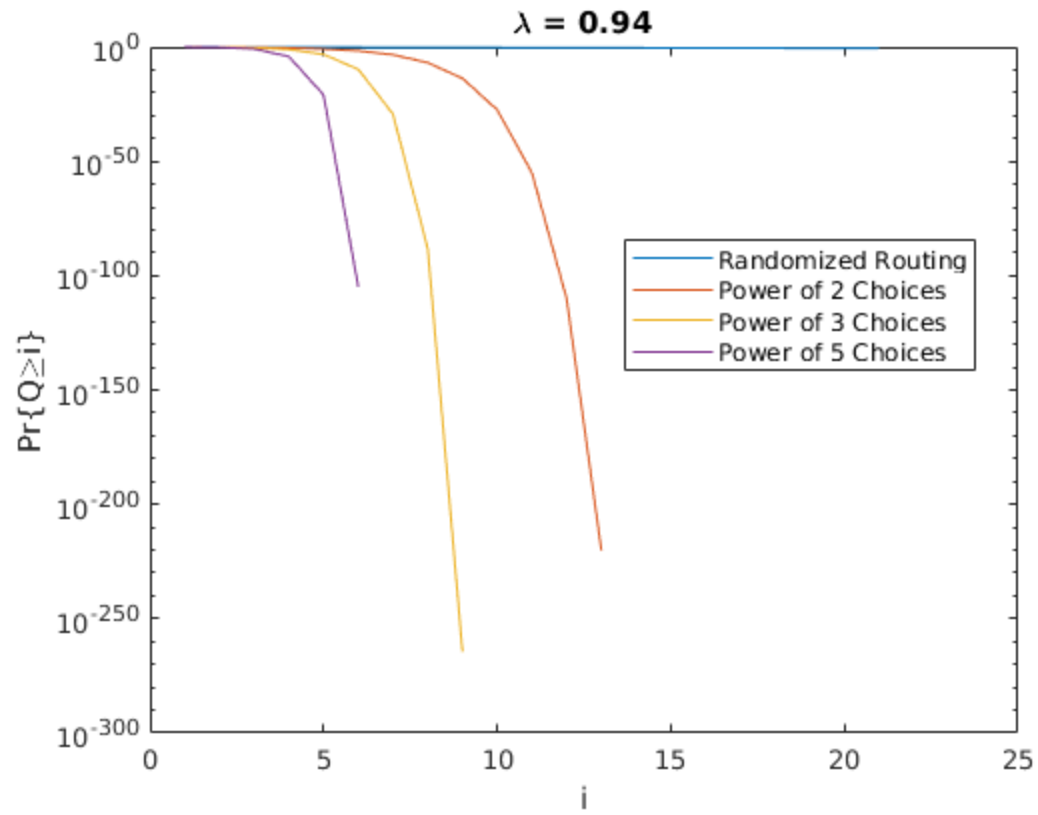


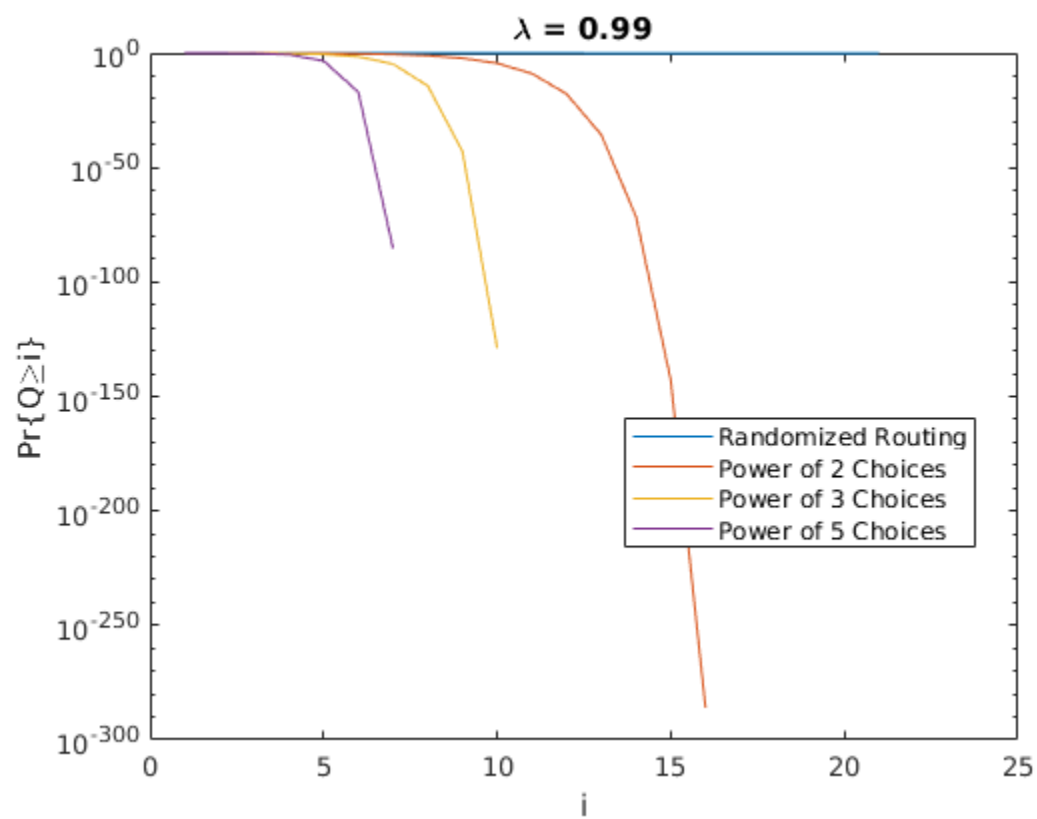
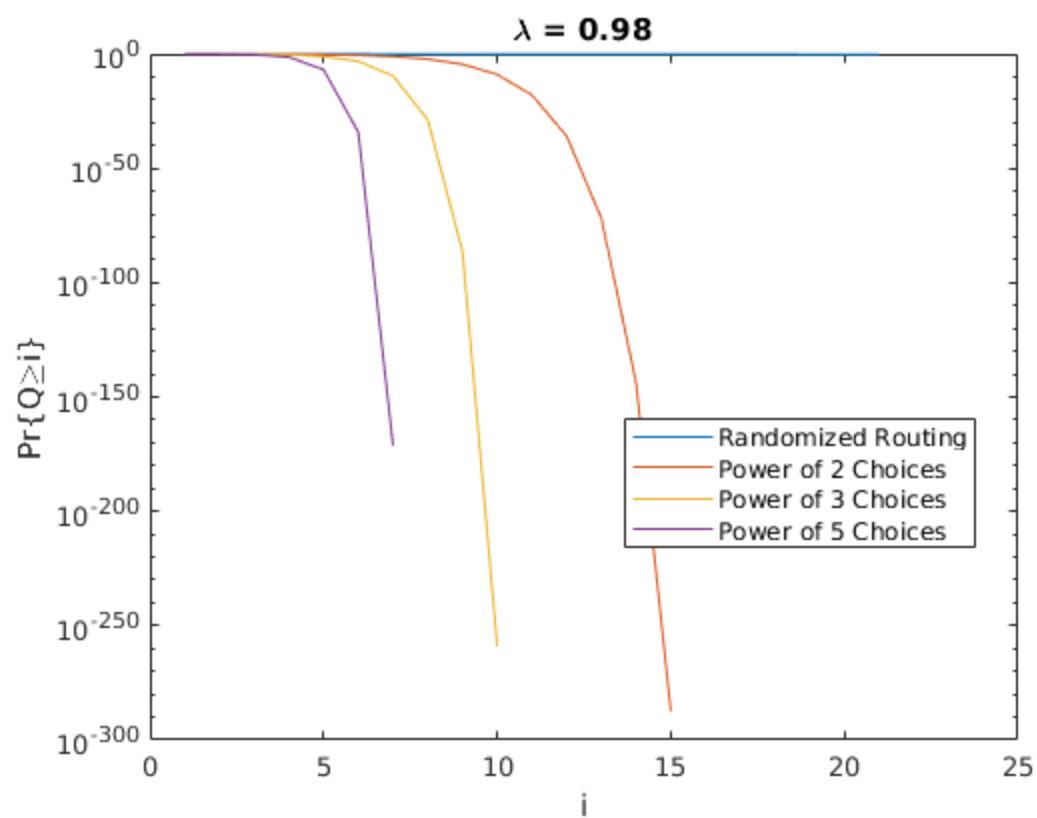


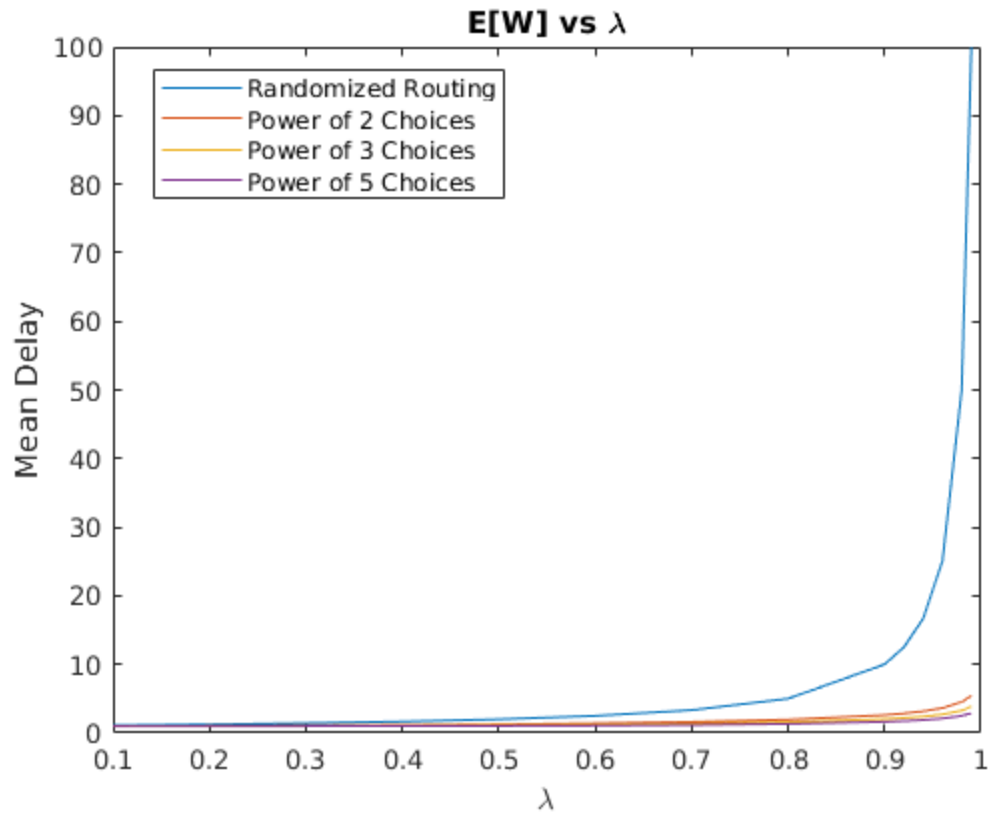












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