

## IV

Combining queues is not the only contribution management science has made to comfort and convenience. Ahn Tran, an undergraduate Engineering student at Cornell, observed that lines form more often and are usually longer at women's rest rooms than at men's. As part of a summer job with the Washington State Department of Transportation, she collected data showing that women take an average time of about 79 seconds to use the facilities, while men take only 45 seconds.

Consider this time a "service time" for queuing analysis. Consider a rest stop on the New York State Thruway with 5 units for each sex. During holiday weekends, the average arrival rate is 200 people of each sex per hour, or 3.33 per minute. Since these people are coming out of New York City, assume an infinite source of patrons.

HINT: Be sure to put everything in terms of minutes and calculate separate models for men and women before comparison. Don't combine the queues. Remember, the average service rate ( $\mu$ ) is the inverse of service time, so the service rate for males would be 1.33 per minute, and for females, service rate would be 0.76 per minute. Arrival rate for each is 3.33 per minute.

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a) For each--what would the average length ( $L_q$ ) of each line be ?

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c) On average, how much longer would a woman spend in the system ( $W_s$ ) than a man?

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d) Many places had laws requiring adjacent facilities to be equal in number for both sexes. Does this study support the reasonableness of those laws? Has Management Science triumphed again?

Total= 75