2DD50 - Exercises week 7

Theory: Kulkarni's book, 6.1, 6.2, 6.3 and 6.4

Conceptual Problems:

6.8 See the text in the book.

6.10 See the text in the book.

6.11 See the text in the book.

Computational Problems:

6.1 See the text in the book.

6.2 See the text in the book.

6.6 Consider the barber-shop as described in the text of this exercise.

a) Classify the model according to the standard nomenclature described in section 6.1.
b) Give the rate diagram for this queueing model.
c) Formulate a set of balance and normalizing equations.
d) Calculate the limiting distribution.
e) What fraction of the customers is lost?
f) Compute the fraction of time the barber is occupied.
g) Make the task as given in the text of this exercise in the book.
h) Determine the expected queueing time.

6.7 See the text in the book.

6.8 Consider the changed situation in the barber-shop as described in the text of this exercise.

a) Classify the model according to the standard nomenclature described in section 6.1.
b) Give the rate diagram for this new model.
c) Formulate a set of balance and normalizing equations.
d) Calculate the limiting distribution.
e) What fraction of the customers is lost?
f) Compute the fraction of time the barbers are occupied.
g) Calculate the throughput of the barber-shop, i.e., the expected number of customers served in the barber-shop per hour.
h) Determine the expected time an entering customer spends in the shop and the expected queueing time of this customer.
i) Make the task as given in the text of this exercise in the book.

6.10 See the text in the book.

6.11 See the text in the book.

6.12 See the text in the book.

6.21 Consider the manufacturing operation described in Conceptual Problem 6.8 with arbitrary λ en μ, but with infinite capacity warehouse.

a) Classify the queueing model for this manufacturing operation according to the standard nomenclature described in paragraph 6.1.

b) Give the rate diagram for the model.

c) Formulate a set of balance and normalizing equations.

d) Give the condition for stability.

e) Take the data from this exercise. Make the tasks as given in the text of this exercise in the book.

6.28 Consider the parking system as described in the text of this exercise.

a) Classify the queueing model for this parking system according to the standard nomenclature described in paragraph 6.1.

b) Give the rate diagram for the model.

c) Formulate a set of balance and normalizing equations.

d) Calculate the limiting distribution.
Hints:

- Show that the limiting probability p_i on state $i = 0, 1, \ldots$ cars at the parking place is equal to $p_i = (\frac{(120)^i}{i!})p_0$ and calculate p_0 with the normalizing equation.
- To calculate p_0, use the following series: $\sum_{i=0}^{\infty} \frac{x^i}{i!} = e^x$.

e) Determine the following steady state performance measures:

- The mean number of cars in the parking lot and the mean waiting time of cars
- The mean number of occupied parking places and the mean parking time of a car.
- The mean number of cars in the queue, waiting for a available parking place and the mean queueing time of a car.
- The fraction of time a certain parking place on the parking lot is occupied.
- The probability that all places are occupied.
- The throughput, the expected number of cars that leave the parking lot per hour.