Homework No. 7

Statistical Analysis of Arrival and Service Processes

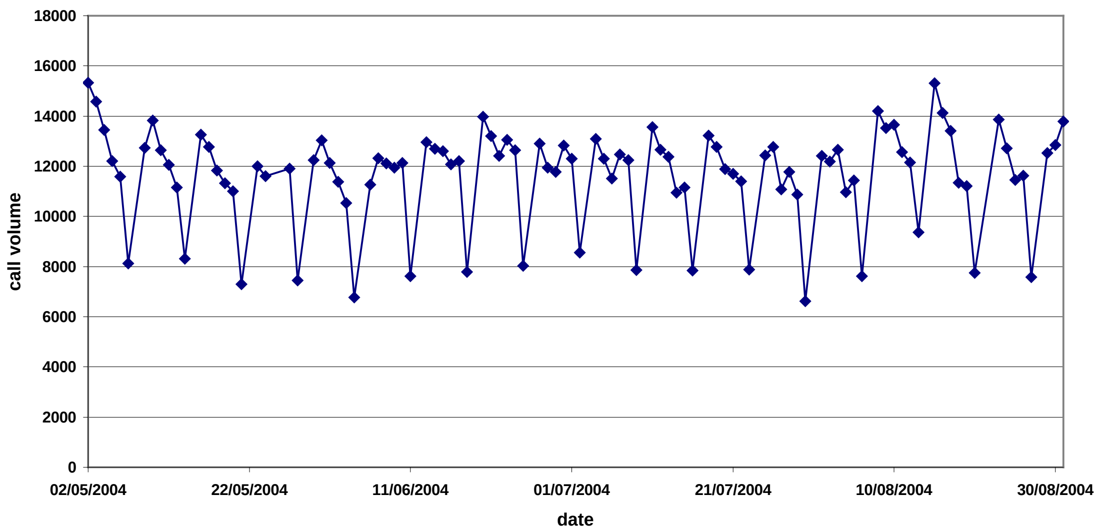
Partial solution

Part 2. Forecasting Arrival Rate at a Call Center.

<u>Questions</u>

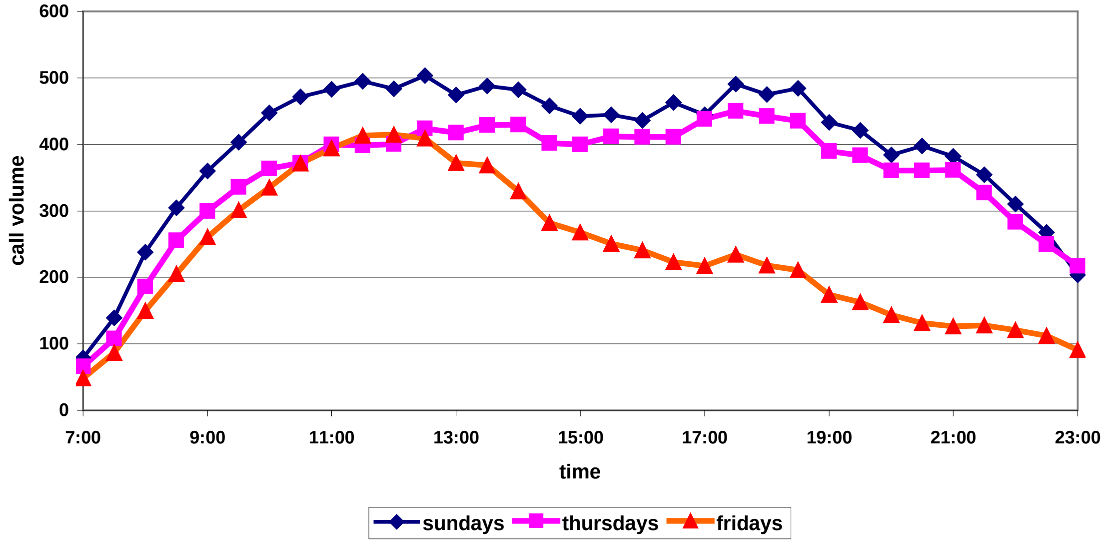
1. Calculate overall daily call volumes for 02/05/04-31/08/04 and plot them (daily call volume versus date). Which conclusions can you derive from this graph?

<u>Partial Solution:</u>



2. Using 02/05/04-31/08/04 data, calculate average intraday arrival volumes during the half-hour intervals for Sundays, Thursdays and Fridays. Compare them in a graphical way. Which conclusions can you derive?

Partial Solution:



4. Forecast the arrival volumes by each method described above. Consider the dates 01/08/2004 and 20/07/2004. Compare in graphical way the arrival volumes in practice with the forecasted valuses (of the 5 methods and the time-series methods). What can you deduce from these results?

Partial Solution:
The file "HW7_2010W_forecast_par_sol.xls" contains forcasting calculations for method 1.

5. Calculate RMSE and APE for the five methods. Provide formulae that you use in Method 5. Compare the methods between them and compare them with the time-series methods considered in Question 3. Summarize your conclusions.

Partial Solution:
Method 1: RMSE=51.60 , APE=13.30 .

7. Consider the call volumes on 17 Tuesdays in May-August 2004, during 10:00-10:30 time interval. Is the following hypothesis plausible: “The call volumes in 10:00-10:30 interval on Tuesday are Poisson random variables with a common arrival rate”.

Hint. You are not expected to perform a complicated statistical analysis.

<u>Solution:</u>

No, this hypothesis is not plausible. We have the sample mean equal to 399, and the sample variance equal to 1929. However, they should be, at least, of the same order, if a Poisson sample is considerd. We observe a classical phenomenon of overdispersion, that has been discussed in lectures.

An alternative model : arrival process is time-inhomogeneous Poisson with rate given by $C \cdot \lambda_{\%}(t)$ where C is the daily arrival volume (random variable) and $\lambda_{\%}(t)$ is the intraday arrival shape ($\int_0^{24} \lambda_{\%}(t)dt = 1$).