

**STAT 495, Fall 2008**  
**Homework Assignment #7**

1. On homework 4, a study was done on the toe alignment on the independent rear suspension system of a particular make and model of automobile. The independent rear suspension is made by an outside vendor. The vendor sets the rear toe alignment in a process that simulates how the suspension will operate in the vehicle. At the assembly plant the rear suspension is united with the underbody. Once the vehicle is assembled, alignment machines measure the total alignment. The actual toe alignment of the independent rear suspension for the finished vehicle is determined from this measurement. The nominal value is 0.36 with a tolerance of  $\pm 0.12$ . Special causes were found for the out of control signals at subgroups 3 and 30. Exclude these subgroups for the evaluation of process capability.
  - a) Verify with an  $\bar{X}$  and s chart combination that once subgroups 3 and 30 are excluded, the process has no subgroups plotting outside the control limits on either chart and so is in a state of statistical control for both short term spread and level.
  - b) From the value of s compute an estimate of the short term standard deviation.
  - c) Perform a process capability analysis on the 240 toe angle measurements. Include both the overall s, for the long term variation, and a user defined sigma using the value from b), this will be the short term variation. Be sure to comment on the values of Cp and Cpk and the actual and predicted proportion of toe angles above and below the specification limits.
2. A decision needs to be made regarding the possible purchase of some new casting equipment. Before proceeding further data is collected to assess the performance of the current equipment. An important part that will consume much of the run time of the equipment is to be used for the study. The width of the cast part at a crucial spot should be  $3.000 \pm 0.025$  centimeters. Below are summarized data from 32 consecutive rational subgroups of size n=5. Analyze the data and comment on the capability of this process. Again summarize your findings for a busy executive and include any graphs you feel will help make your case.

Subgroup	$\bar{X}$	Range	Subgroup	$\bar{X}$	Range
1	2.991	0.038	17	3.005	0.039
2	3.004	0.027	18	3.008	0.054
3	2.997	0.049	19	3.001	0.009
4	3.004	0.033	20	3.000	0.062
5	2.999	0.043	21	2.993	0.034
6	3.000	0.070	22	2.982	0.012
7	2.988	0.044	23	2.990	0.028
8	2.986	0.050	24	3.003	0.091
9	2.991	0.064	25	3.007	0.049
10	2.994	0.048	26	2.998	0.052
11	3.017	0.070	27	3.012	0.077
12	2.987	0.051	28	2.996	0.040
13	3.013	0.060	29	2.997	0.018
14	2.993	0.019	30	3.004	0.020
15	3.009	0.044	31	2.987	0.063
16	2.990	0.043	32	3.002	0.028