Homework 6

Due: Friday, May 6

Question 1. Suppose we have conducted 6 null hypothesis tests, with p-values as

Test #	p-value
1	0.006
2	0.035
3	0.002
4	0.041
5	0.023
6	0.078

Use both Bonferroni correction and Holm-Bonferroni method to determine which tests should be rejected when the family-wise error rate is $\alpha = 0.05$.

Question 2. A machine shop contains 3 ovens that are used to heat metal specimens. Subject to random fluctuations, they are all supposed to heat to the same temperature. To test this hypothesis, temperatures were noted on 15 separate heatings. The following data resulted.

Oven	Temperature
1	492.4, 493.6, 498.5, 488.6, 494
2	488.5, 485.3, 482, 479.4, 478
3	502.1, 492, 497.5, 495.3, 486.7

Do the ovens appear to operate at the same temperature? Test at the 5 percent level of significance. What is the p-value? (assume the population distribution is normal)

Question 3. Suppose that a process is in control with $\mu = 14$ and $\sigma = 2$. An $\overline{X}$-control chart based on subgroups of size 5 with significance level of 0.05 is employed. If a shift in the mean of 2.2 units occurs, what is the probability that the next subgroup average will fall outside the control limits? On average, how many subgroups will have to be looked at in order to detect this shift?

Question 4. A manufacturer produces steel shafts having diameters that should be normally distributed with mean 3 mm and standard deviation 0.1 mm. Successive samples of 4 shafts have yielded the following sample averages in millimeters.
Draw the $\overline{X}$-control chart with LCL and UCL (use $\alpha = 0.05$) and determine whether the process is in control or not.

Subgroup	$\overline{X}$	Subgroup	$\overline{X}$
1	3.02	6	3.02
2	2.96	7	3.11
3	3.11	8	3.17
4	3.15	9	3.06
5	2.89	10	2.99

Question 5. When a certain manufacturing process is in control, it produces items whose values are normally distributed with mean 10 and standard deviation 2. We have drawn 8 successive subgroups of size 5 and their sample averages are shown as below.

Subgroup	$\overline{X}$
1	9.6
2	10.3
3	9.9
4	10.8
5	10.6
6	10.4
7	13.3
8	9.5

Derive the 5-step moving averages and compute the LCL and UCL for the moving-average control chart with a significance level of 0.05.