Response Surface Methodology, Stat 579 Project Contest Results Name: Answer Key
Fall 2014 Prof. Erik B. Erhardt

Part I. (0 points) Contest guidelines:

- For each drop, all teams will drop at the same time with time keepers below starting together and stopping when their helicopter hits the floor.
- Each team gets one mulligan (redrop) if it hits a wall or otherwise flies unimpeeded.
- Erik will analyze the data after each drop once each team has 3 drops and no more than 6.
- When one team is statistically better than the other two, the contest ends, with second and third place decided by the relative positions of the mean.
- If no team is statistically better after 6 drops, then the rank of means determines positions.
- Ranking will be given for both best helicopter before cost and with cost (of 0.2 seconds added for each helicopter used in the project).
- If normality assumptions are wildly violated, a permutation version of ANOVA will be used.
- Tukey tests will be used, but Fisher LSD tests may be used instead at Erik's discretion.

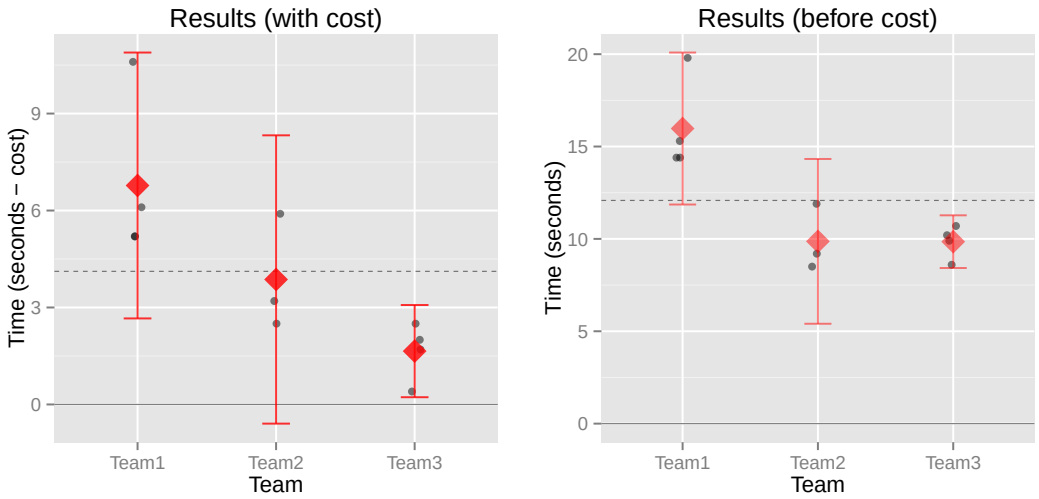
(0^{pts}) **1. Project Contest Results.**

Helicopters were dropped from the third floor of Dane Smith Hall at the University of New Mexico. Team 2's second drop landed on the second floor. Team 3 pursued the Definitive Screening Design approach, but did not find curvature until after steepest ascent and performed their Central Composite Design near the maximum subject to a paper size contraint. Teams realized a roughly 60% increase in flight time moving from the center of the original design region to the optimum.

Results Team 1 (Caroline Bouvie, Zhanna Galochkina, Yuridia Leyva), with the lighter paperweight, had a significantly longer flight time without and with the 0.2 second/helicopter cost. Team 2 (Jacob Kline, Olayan Albalawi) and Team 3 (Ayed Alanzi, Tamara Armoush, Bose Falk) are tied for second in both cost categories.

Solution:

drop	Team1	Team2	Team3
0	46.0	30.0	41.0
1	19.8	8.5	10.2
2	14.4		10.7
3	14.4	11.9	9.9
4	15.3	9.2	8.6
5			



Summaries with cost and without cost.

Team	m	s	morg	sorg	n
Team1	6.8	2.6	16.0	2.6	4
Team2	3.9	1.8	9.9	1.8	3
Team3	1.6	0.9	9.8	0.9	4

Analysis of time with cost.

Df	Sum Sq	Mean Sq	F value	Pr(>F)
2	52.8	26.4	7.3	0.016
8	28.9	3.6		

```
# Fisher's LSD (FSD) uses "none"
pairwise.t.test(dat.time$time, dat.time$Team, pool.sd = TRUE, p.adjust.method = "none")

##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  dat.time$time and dat.time$Team
##
##       Team1  Team2
## Team2 0.0801 -
## Team3 0.0051 0.1653
##
## P value adjustment method: none
```

Analysis of time without cost.

Df	Sum Sq	Mean Sq	F value	Pr(>F)
2.000	95.272	47.636	13.185	0.003
8.000	28.904	3.613		

```
# Fisher's LSD (FSD) uses "none"
pairwise.t.test(dat.time$timeorg, dat.time$Team, pool.sd = TRUE, p.adjust.method = "none")

##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  dat.time$timeorg and dat.time$Team
##
```

```
##       Team1  Team2
## Team2 0.0030 -
## Team3 0.0019 0.9911
##
## P value adjustment method: none
```