ASE 381P Exam #1

Posting Date: October 9, 2019

Exam Rules: Do all problems. Do problems on standard 8 1/2 by 11 inch paper. Hand in the completed exam as you enter class at our usual time, 2:00 pm on Thursday, October 10, 2019. No collaboration or consultation is allowed with any other person besides Dr. Humphreys. He is willing to talk about problems if he's available. You may use non-human outside sources (e.g., books). If you use such sources, please list them.

1. **[15 points]** Problem Set 1, Number 10.
2. **[10 points]** Problem 1-9 in Bar Shalom.
3. **[15 points]** Problem Set 2, Number 5 with two changes: (1) in part (b) use $P_F = 0.01$ instead of $P_F = 0.03$, and (2) in part (e) assume $\sigma_1/\sigma_0 = 6$.
4. **[10 points]** Problem Set 2, Number 6 with the change that $N = 6$ and $\boldsymbol{y}^* = [0, 0, 1, 1, 0, 1]^T$.
5. **[15 points]** Problem 2-1 in Bar Shalom (with the clarification offered in the problem set).
6. **[15 points]** Problem 2-14 in Bar Shalom (with the clarification offered in the problem set).

   Do this problem in two parts: (1) by assuming a Gaussian distribution for the error in the estimate of the variance, as described in the book's hint, and then (2) by assuming that the original error measurements from which $\hat{\sigma}^2$ is derived are Gaussian distributed and using this fact to derive the *actual* distribution for the error in the estimate of the variance (which is not exactly Gaussian). Compare the results.
7. **[10 points]** Problem Set 3, Number 5.
8. **[10 points]** Problem Set 3, Number 2 except use the values for $\boldsymbol{z}$, H, and R given below. Compare the answer for $\hat{\boldsymbol{x}}$ returned by your function to the answer provided by the standard weighted least squares technique (i.e., by the normal equations). Turn in a paper copy of your code. Note that you should be able to copy and past the numbers below into your editor. (Don't type them in by hand!)

z =

```
   34392.7080226075
    95049.241211972
  -165957.584445193
   12813.3430731501
   33744.0080015867
  -107847.178062601
```

H =

```
     537.6671395461   -303.514415613978    2118.36542708511
    1833.88501459509    239.837126577055    5422.13861846274
   -2258.84686100365    2504.87785780803   -10638.8090086238
    862.173320368121    1938.60592091941   -33.0051183925756
    318.765239858981   -944.920858109565    2337.75095208492
   -1307.68829630527    2124.4464264323   -7112.64499263293
```

R =

```
 4.48969254194419e-06  -5.3639754880881e-08  -2.82108367550151e-07   1.15527795296165e-07  -2.49965420713856e-06   6.36392589368105e-07
 -5.3639754880881e-08   6.07007287029812e-06  -2.62065228561023e-06   3.81520661439239e-06   4.6837147858155e-07   8.24799673475808e-07
-2.82108367550151e-07  -2.62065228561023e-06   6.68658685773165e-06  -8.8120668398492e-07   2.99242554994465e-07   2.08470773900216e-08
 1.15527795296165e-07   3.81520661439239e-06  -8.8120668398492e-07   6.07371651695821e-06   2.63707372141155e-06   3.55951797531251e-07
-2.49965420713856e-06   4.6837147858155e-07   2.99242554994465e-07   2.63707372141155e-06   4.55596815512913e-06  -1.40588403974735e-06
 6.36392589368105e-07   8.24799673475808e-07   2.08470773900216e-08   3.55951797531251e-07  -1.40588403974735e-06   2.43477996714807e-06
```