ASEN 5070
Exam No. 3
12/10/06
Open book and notes take home exam.
Please do not give or accept help on this exam.
Due 12/21/07

1. (25%) A spacecraft is to fly by a comet whose radius is 2 km. The time of closest approach is t_k. At t_k an estimate and variance-covariance are calculated of the spacecraft position. The estimate is calculated in a 2-D coordinate system in a plane that contains the center of the comet and the spacecraft at t_k, with the center of the comet at the origin of the coordinate system. The values for the nominal trajectory and estimate (in km) at t_k in this 2_D coordinate, and the variance-covariance for the errors in $\hat{x}$ are

$$X^* = \begin{bmatrix} 4 \\ -1 \end{bmatrix}, \quad \hat{x} = \begin{bmatrix} -2 \\ -5 \end{bmatrix}, \quad P = \begin{bmatrix} 9 & 4.8 \\ 4.8 & 4 \end{bmatrix}.$$

   a. What is the correlation coefficient?
   b. At closest approach, sketch the comet, the spacecraft's estimated position, and the 3-σ probability ellipse.
   c. Is the comet outside of the 3-σ probability ellipse?

2. (30%) Problem # 42 of the text.

3. (20%) Problem # 43 of the text, parts a and b.

4. (25%) Answer true or false

   a. In the general orbit determination problem the estimation error covariance matrix will be a realistic estimate of solution accuracy_____

   b. The semimajor, semiminor, and intermediate axes of the probability ellipsoid lie along the principal axes _____

   c. A major advantage of the state noise compensation technique is that it provides an estimate of the unmodeled acceleration_____

d. A major advantage of solution via orthogonal transformations is that accuracy is enhanced because only the H matrix and not H^TH is operated on_____

e. In general, the larger the absolute value of the correlation coefficient between two parameters, the more accurate the solution for the individual parameters_____