Final Examination, **AOE 5784, Model-Based Estimation.** Fall 2022

Exam rules: Do all problems. Download exam at 12 noon on Tuesday Dec. 13, 2022 and hand in completed exam by 12 noon on Wednesday Dec. 14, 2022 by uploading it to the course Canvas site. No collaboration or consultation is allowed with any other humans except Prof. Psiaki. He is willing to talk about problems if available. You may use (inanimate) outside sources (e.g. books). If you use such sources, then list them.

[15 pts] Problem 3-7.1 & 3-7.2 in Bar-Shalom.

[15 pts] Problem 5-5.1 in Bar-Shalom

[15 pts] Problem 10-3.1 & 10-3.2 in Bar-Shalom

[20 pts] Problem Set 7, Number 5.

[15 pts] Problem Set 8, Number 5, except use the UKF tuning value $\alpha = 0.25$ instead of $\alpha = 1$. Keep κ and β unchanged. Hand in your UKF code, plots of your estimated state time history (plotted as points, not connected lines) and your covariance square-root time history, i.e., your UKF's computed state estimation error σ time history. Also, give the numerical values for your state estimate at the final 3 samples, i.e., give numerical values for $\hat{x}(98)$, $\hat{x}(99)$, and $\hat{x}(100)$. Give them to at lest 14 significant digits, i.e., using MATLAB's "format long" format.

[20 pts] Problem Set 8, Number 8, except use the data and the model in kf_example02b.m -- the model with Qk = 40. Hand in your UKF code, plots of your estimated time histories for the two states, and your terminal state estimate and estimation error covariance matrix. Hand in these latter values using MATLAB's "format long" format.