What type of problems will be on the Final Exam?

The Final will contain True/False questions, and will also be sprinkled with some word questions that measure understanding. The computational problems will be of the following types:

1. For a system $AX = b_t$ where $b_t$ depends on $t$ find all $t$ for which $AX = b_t$ is consistent. Write the solution in parametric form.
2. Decide whether a matrix is invertible, and if yes compute its inverse.
3. Find an orthonormal basis in a given subspace $H$, and find a matrix $P$ such that the projection of a vector $y$ to $H$ is given by $Py$. (Here $P = UU^\top$ where columns of $U$ form an orthonormal basis in $H$).
4. Find eigenvalues of an arbitrary $3 \times 3$ matrix using the method of handout to 5.2 (in HW13 on the course website). The matrix will not have any special block structure.
5. Compute complex eigenvalues/eigenvectors of a $2 \times 2$ matrix $A$. Find $P$ such that $PAP^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$.
6. For a given matrix $A$ that has distinct real eigenvalues, compute $A^k$ (by finding $P$ such that $P^{-1}AP$ is diagonal, and taking $k$th power of $P^{-1}AP$).
7. Solve a least square problem as in 6.5-6.6 (tentatively, this will be a curve fitting problem as in 6.6).
8. Find interval of convergence of a power series.
10. Compute a limit (indeterminate form).
11. Estimate an integral/function via remainder method with error $< \frac{1}{100}$. (The problem will be such that an alternating series method cannot be used, e.g. $\int_0^2 e^{x^2} dx$).