

# Preparing for the Final

Please print your name:

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**Problem 1.** The final exam will be comprehensive, that is, it will cover the material of the whole semester.

- (a) Do the practice problems for both midterms.
- (b) Retake all quizzes and both midterms (posted with and without solutions).
- (c) Do the new third set of practice problems were compiled from the examples from our lectures.
- (d) Do the problems below. (Solutions will be posted soon.)

**Bonus challenge.** Let me know about any typos you spot in our lecture sketches or the posted solutions (surely, there should be some). Any typo that is not yet fixed on our course website by the time you send it to me, is worth a small bonus.

**Problem 2.** Find the best approximation of  $f(x) = x$  on the interval  $[0, 4]$  using a function of the form  $y = a + b\sqrt{x}$ .

**Problem 3.** Give a basis for the space of all polynomials  $p(x)$  of degree 4 or less such that  $p(0) = p(1)$  and  $p'(-1) = 0$ .

**Problem 4.** Consider the edge-node incidence matrix

$$M = \begin{bmatrix} -1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 1 & 0 \\ -1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 1 \\ 0 & 0 & 1 & 0 & -1 & 0 \end{bmatrix}.$$

- (a) Sketch the directed graph defined by  $M$ .
- (b) By inspecting the graph, give a basis for  $\text{null}(M)$ .
- (c) By inspecting the graph, give a basis for  $\text{null}(M^T)$ .