# Quiz: Computational Linear Algebra

**Printed Name:**

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**Quiz rules:**

1. You MAY use:
   (a) any notes (handwritten, printed, or electronic),
   (b) any computer programs (including websites like WolframAlpha or ChatGPT), and
   (c) any additional scratch paper.
2. You MAY NOT communicate with another student.
3. If you finish the quiz early, stay seated. I will collect all the quizzes at the same time.

**Problem 1.** For each statement below, circle `True` if the statement is known to be true, `False` if the statement is known to be false, and `Open` if the statement reduces to an open problem. You will receive +1 point for each correct answer, **-0.5 points for each incorrect answer**,[1] and 0 points for each blank answer.

1. `True` `False` `Open` Let $f(a,b) = 5a^2b + 4ab + 3ab^2 + 2a + b$. Then $f = O(a^2b + ab^2)$.

2. `True` `False` `Open` Let $A$ and $B$ be $n \times n$ matrices. The fastest algorithm for computing the matrix product $AB$ has runtime $O(n^2)$.

3. `True` `False` `Open` Let $A : n \times n$. Then the best possible runtime of computing the expression $A(A^TA)^{-1}$ is $O(n^2)$.

4. `True` `False` `Open` Let $A : n \times n$ and $\mathbf{x} : n$. Further let $\lambda$ be a real number and $I$ the $n \times n$ identity matrix. Then the best possible runtime of computing the expression $\|(\lambda I + A)\mathbf{x}\mathbf{x}^T\|_F$ is $O(n^2)$.

[1] I've reduced the penalty for incorrect answers. The reduced penalty will still discourage guessing without penalizing minor mistakes as much.