Name: _____

Date: _____

Collaborators: _____

(If applicable, collaborators submit their individually written assignments together)

Question:	1	2	3	4	5	6	7	Total
Points:	15	10	10	5	20	10	10	80
Score:								

Instructor/grader comments:

Complexity

1. (15 points) Find the **leading** in n term (assume $n \gg 1$) of the following sum: Show all your calculations in the space below.

$$S(n) = \sum_{i=1}^{2^n} i \log(i)$$

2. (10 points) **Estimate** the number of floating point operations required to evaluate the determinant of a matrix of size n using LU factorization. Keep only the leading term in n.

   It takes about 10^{-2} seconds (on a slow computer) to evaluate (using LU-factorization) the determinant of a random matrix of size 10^4. **Estimate** how long it takes to evaluate the determinant of a random matrix of size 10^6.

   Present your answer and explain your reasoning in the space below.

Vector and matrix norms

3. Find l_1, l_2 and l_∞ norms of the vectors. Show all your calculations in the space below.
   (a) (5 points) $x = (3, -4, 0)$
   (b) (5 points) $x = (1, 2, 3, 4)$

4. (5 points) Find l_∞ and l_1 norms of the matrix. Show all your calculations in the space below.

$$\begin{bmatrix} 2 & 5 & 0 & 0 & 0 & 0 & 0 & 3 \\ 0 & -5 & 3 & 2 & 4 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2 & 0 & 2 & 1 & 0 \\ 1 & -1 & -1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & -1 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 & -1 & 0 & 1 & 0 \end{bmatrix}$$

Matlab

5. (a) (10 points) Write two matlab functions, `hw05p5normone` and `hw05p5norminf`, that accept a rectangular matrix as a parameter and calculate one-norm and infinity-norm of that matrix. Place the functions in their own files. Provide the help texts.

   Hints: Use `help sum` to find out what parameters the function `sum` accepts; Use `help abs` to find out what the function `abs` to a matrix.

   (b) (10 points) Write a matlab script (call it **hw05p5.m**) that tests your functions (by **comparing** the norms with the results returned by matlab's own `norm` function) using two random matrices of size $n = 50$. Use `help norm` to find out what parameters the function `norm` is required. Include the help commands for your functions in your script. Initialize the random number generator with a seed of your choice. Place the commands `clear`, `format compact` at the top of your script.

Reading

6. (10 points)

   I read the article What is a plain English explanation of Big O notation?

   Sign and date here: _____

Gitlab

7. (10 points) Create a gitlab project called **hw05** (name it exactly as shown). Upload **all** matlab files that are required to run your code. **Do not** upload other types of files (e.g. no graphics files). Share the project with the instructor (gitlab user name `m3510_21f_in`) and the TA (gitlab user name `m3510_21f_ta`) and grant them the **Reporter** privileges.