

Show all your work and indicate your reasoning in order to receive the credit. Present your answers in *low-entropy* form.

Name: _____

Date: _____

Question:	1	2	3	4	5	Total
Points:	15	10	25	25	25	100
Score:						

Honor pledge

I affirm that I have not given or received any unauthorized help on this exam, and that this work is my own.

Sign and date here: _____

Instructor/grader comments:

Floating point numbers

1. Floating point numbers typically represented in computers in the following binary form:

$$x = \pm \left(1 + \frac{b_1}{2} + \frac{b_2}{2^2} + \dots + \frac{b_d}{2^d} \right) \times 2^E$$

- (a) (5 points) What is the (approximate) value of machine epsilon for a microprocessor that uses $d = 10$? Briefly explain.
- (b) (5 points) For the same microprocessor, how many floating point numbers x , such that $7 \leq x < 8$ are there? Briefly explain.
- (c) (5 points) For the same microprocessor, assuming that the smallest possible value of E is -15 and the largest possible value of E is 16, what are (approximately) the smallest and the largest positive floating point number? Briefly explain. Express your answer as a power of 2 and as a nearest power of 10 (approximately).

Public keys encryption

2. You selected two prime numbers, $p = 9923$ and $q = 5051$ to create a toy private and public RSA encryption keys. You published the pair $(50121073, 19)$ as your public key.
- (a) (5 points) What is your private key? _____
- (b) (5 points) You received an encrypted message 29556352 that is a date in the format MMDDYYYY encrypted using your public key.
- What is the date? _____
- (c) (0 points) What physics-related event happened on that date?

Linux; Julia programming

- 3.
- (a) (5 points) Ssh to your virtual machine (with an ssh tunnel connecting ports 8888 on both ends)
- (b) (5 points) Create a directory for this exam, eg. **m1**. What command you used to create the directory?
- (c) (5 points) Switch to that directory. What command you used to change the directory?
- (d) (5 points) Start julia, switch to the package mode and activate your project. Install the packages `Julia` and `PyPlot` locally.
- (e) (5 points) Launch a jupyter server. Use jupyter interface to create a notebook. Place all the julia code you use in Problem 2 into the notebook. Your notebook must be runnable and should print all intermediate results (e.g. write one code line per cell). Save the notebook as the file **m1p3.ipynb**.

4. (25 points) Fibonacci numbers, commonly denoted F_n , form a sequence, such that each number is the sum of the two preceding ones, starting from $F_1 = 1$ and $F_2 = 1$:

$$F_n = F_{n-1} + F_{n-2}, \quad n = 3, 4, \dots$$

Work in the same folder you created in Problem 3. Use jupyter interface.

Write a Julia function, `myfibonacci(k)` that calculates and returns the first k Fibonacci numbers. The function must preallocate the storage for the returning values (Use the function `ones(k)`.) Make sure the cases $k = 1$ and $k = 2$ are treated properly. The function must not print anything.

Use your function to plot the graph of the first 20 Fibonacci numbers. Use `semilogy` axes. Provide axes labels, grid, title.

Save the notebook as **m1p4.ipynb**.

Git and Gitlab

5. (a) (5 points) Convert the directory you created for the exam to a git repository. What command(s) you used?
- (b) (5 points) Download a suitable `.gitignore` file. Check the files you created for the exam into the git repository. What command(s) you used for checking in?
- (c) (5 points) Create a Gitlab repository for the exam. Call it **midterm1** (the name must be exactly as shown). Push the content of the git repository from your virtual machine to Gitlab server.

What command(s) you used to push the content?

- (d) (5 points) On the gitlab server, add *README.md* file to your project and edit it to add some meaningful content. Synchronize your remote and your local repositories

What command(s) you used for pulling the content from the remote git repository ?

- (e) (5 points) Grant the access to your project (with the permission of the *Reporter*) to the instructor.