KUTAISI INTERNATIONAL UNIVERSITY

Numerical Linear Algebra

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Topics

1. Numerical solution of linear systems
2. representation of numbers in computer
3. Modeling, refining and developing models
4. Applying methods to practical problems

Connections with PLOs

- PLO7: an ability to search for, process and analyze information from a variety of sources and to communicate in a professional way orally and in written form)
- PLO5: an ability to design mathematical models in a broad range of intellectual domain
- PLO4: an ability to identify, formulate, abstract and solve mathematical problems applying analytical, symbolic and computatioanl methods together with computing facilities
- PLO3: understanding of limitations of mathematical methods and the constraints on their applicability

Problem 1.1

Develop and apply Hill Cipher in two digit arithmetic

Input

- text file
- audio file

Tasks

1. Read input file
2. Convert input data to two digit floating point data D. Depending on you choice D could be vector or matrix. Describe method of conversion.
3. Generate key matrix K. Describe your method. Consider two cases, K with integer entries and K with floating point entrie
4. Encrypt your data and obtain $E = KD$
5. Decrypt using inverse of K or solution of linear systems and compute $\tilde{D} = K^{-1}D$. Apply one direct method and one iterative method.
6. Analysis and conclusions:
   - Convert $\tilde{D}$ to input data format
   - Can you recover the original data? what is accuracy? Why you obtain this result?
   - Is your method fast enough? whta are memory requirements? can you apply it in practice? if yes, where?
   - What are advantages and drawbacks of your method?

Assessment

- CP is worth of 12 points
- Each sub-task is worth 1 point for one type of input file
- Each item/sub-problem should be documented including inputs and outputs of important intermediate steps
- The problem/sub-problem is assigned 0 point if
  - same set of student defined parameters are used by two or more students
  - answer cannot be replicated
  - solution of sub-problem is submitted without explanation/proof
  - code fails: does not produce correct results on new tests