SCOPE OF QUESTIONS FOR THE FINAL EXAM - MSc. INFORMATICS

I. COMMON COURSES FOR ALL SPECIALIZATIONS

Analysis and Design of Information Systems

- 1. UML activity diagram
- 2. UML sequence diagram
- 3. UML timing diagram
- 4. UML class diagram
- 5. UML use case diagram

Computer Vision and Pattern Recognition

- 1. Point-based operations in image processing
- 2. Context-based operations in image processing
- 3. Edge detection
- 4. Fourier transform in image processing
- 5. Mathematical morphology
- 6. Image segmentation
- 7. Feature extraction of image data
- 8. Statistical classifiers
- 9. Clustering techniques
- 10. Convolutional neural networks

Digital Modeling

- 1. Solving differential equations using the L-C transform and difference equations using the Z transform
- 2. The concept of a gradient, non-gradient methods and gradient ones of determining the minimum of a multivariate function
- 3. Methods of obtaining state equations
- 4. Generating of pseudorandom numbers by the elimination method examples
- 5. Generating of pseudorandom numbers using the method of inversion of cumulative probability function examples

Algorithms and Data Structures

- 1. Persistent data structures
- 2. Trees and suffix arrays
- 3. Shortest paths in weighted graphs
- 4. Flow networks
- 5. Optimization metaheuristics

Performance Evaluation of Computer Networks and Systems

- 1. Discrete-event simulators design and applications
- 2. Performance characteristics of queueing systems and general relations between them
- 3. Queueing systems M/M/1 and M/G/1, average queue sizes
- 4. Discrete-time Markov chains
- 5. Continuous-time Markov chains

Nanoscience and Nanosystems of Informatics

- 1. Information storage and processing in a biological cell
- 2. Nanotechnology and its example products for building nanosystems
- 3. Principle of operation of a quantum computer

Theory of Data and Algorithms Spaces

- 1. Theory of data space and algorithms definition
- 2. Classical data warehouses
- 3. Evolution of analytical systems
- 4. Advanced data warehouses (stream, spatial, temporal, trajectory, real-time, aggregate granaries)
- 5. Advanced algorithms (aggregate materialization, data extraction restoration, privacy protection)

II. COMMON COURSE FOR SPECIALIZATION – INTERNET OF THINGS

Advanced Vision, Motion and Image Analysis

- 1. Perspective projection
- 2. Intrinsic and extrinsic camera parameters
- 3. Lens distortion
- 4. Detection of calibration patterns
- 5. Camera calibration using a pattern
- 6. Camera calibration without using a pattern
- 7. Calibration of a stereo vision system
- 8. Correspondence detection between images
- 9. Image rectification
- 10. Measures of the similarity between two pictures
- 11. Gaussian pyramid
- 12. Map of disparity between two images
- 13. Depth map and reconstruction of the three-dimensional content of a scene
- 14. Methods of fitting a plane to three-dimensional data and a disparity map
- 15. Sparse and dense optical flow
- 16. Feature point detectors

IoT Networks

- 1. Bluetooth Low Energy protocol
- 2. MQTT and CoAP protocols
- 3. Thread protocol
- 4. LoRa protocol
- 5. Data flow in IoT networks from IoT node to the Cloud
- 6. IoT network topologies and their features

IoT Security

- 1. Vulnerabilities in IoT systems
- 2. Local IoT network configuration in aspects of the security
- 3. Methods of cyberattacks on IoT system

Advanced IoT Hardware

- 1. ESP8266 and ESP32 SoCs
- 2. Main features of the nRF52 family of SoCs
- 3. Choose and describe what kind of device would you use as IoT Edge computer
- 4. Choose and describe what kind of device would you use as the BLE to LAN gateway
- 5. Choose and describe what kind of device would you use as the LoRa gateway

Distributed Systems and Cloud Computing

- 1. Cloud computing concept, properties, models, and Cloud resources
- 2. Scalability, availability, durability, fault tolerance, security, and Cloud economy
- 3. V model, motivations, and usage scenarios of Big Data
- 4. Tools and frameworks of Hadoop ecosystem, MapReduce processing, job execution
- 5. Data centers and Big Data and Cloud complementarity

Advanced Data Science

- 1. Metrics of classifier evaluation
- 2. Conditional probability rule and the Bayes theorem
- 3. Binary data classification k-nearest neighbors algorithms
- 4. Methods of dimensionality reduction chosen examples
- 5. Data preparation and cleaning (missing values, imbalanced data, etc.)