*Computer Science MSc*

**ZÁRÓVIZSGA TÉTELEK**

**2018. JÚNIUS**

**COMPUTER SCIENCE MSC**

**TÖRZSTÁRGYAK I.**

*Automata and formal languages*

1. The unicity and the algorithmic construction of the minimal automaton.

2. Parikh's theorem and its consequences.

*Application of Linear Programming*

3. Duality, dual simplex algorithm. Integer programming.

4. Assignment and transportation problem.

*Advanced Programming*

5. Generic programming, templates, expression templates, metaprogramming.

6. Standard Template Library implementation and usage: data streams, manipulators, generic

algorithms, predicates, function objects, generic containers and iterators .

*Advanced Image Processing*

7. Morphological operations on binary and multiscale images; Skeletonization: distance transform,

thinning, Voronoi-skeleton.

8. Textures: statistical texture features, syntactic texture description.

*On-line Algorithms*

9. Definition of competitive ratio and asymptotic competitive ratio. Ski rental problem, and

algorithms for its solution. The paging problem, FIFO and the marking algorithms. Scheduling,

list algorithm for scheduling.

10. The definition of the bin packing problem, algorithms NF, FF, BF. Proof: NF is 2-competitive. No

online algorithm exists for bin packing with smaller asymptotic competitive ratio than 4/3.

Multidimensional generalizations of bin packing. NFSr strip packing algorithm.

11. The Web caching problem and the algorithm Landlord. The data acknowledgment problem and

the algorithm Alarm. The online k-server problem and the double coverage algorithm.

*Machine Learning*

12. Supervised learning approaches (decision trees, linear machines, SVM, neural networks)

13. Bayesian classifiers (parameter estimation techniques, naive Bayes, non-parametric classifiers)

14. Unsupervised learning (approaches for clustering, clustering algorithms, Expectation-

Maximization)

*Advanced Graphical Algorithms*

15. Geometrical transformations: Transformation Pipeline, Special Transformations, Quaternions.

16. Realistic scene: Environment mapping, Bump mapping, Reflections, Planar Shadow.

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*Advanced Approximate and Symbolic Computations*

17. Orthogonal transformations and their usage in numerical linear algebra (orthogonal-triangular

decompositions, QR-algorithm).

18. Interpolation and approximation of continuous functions (spline and trigonometric interpolation,

least-squares and uniform approximation).

*Program Systems Development*

19. Distributed system, issues, architectures.

20. Data persistence solutions (ORM, NoSQL, …)

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**TÖRZSTÁRGYAK II.**

*Data Mining*

1. Data representation, levels of measurement, dimensionality reduction and feature selection

techniques.

2. Frequent pattern mining and association rule mining. The A Priori principle. FP trees.

3. Web data mining: (personalized) PageRank, Hubs and Authorities algorithms and the basic

concepts of information retrieval.

*Game theory*

4. Connection of matrix games and Linear Programming. Minimax theorem.

5. Non zero sum games and their applications. Nash equilibrium.

6. Cooperative games, core, stable sets, stable matching and the Shapley value.

*Nonlinear programming*

7. Convex sets and convex functions in optimization

8. Iterative procedures for unconstrained problems

9. Equality- and inequality constrained optimization

*Software development*

10. What types of MFC applications are supported by Visual Studio C++ (Dialog Based, SDI, MDI)

and the main features of them? What are the most important settings of the Application Wizard,

the services, the functioning of the generated initial skeleton code?

11. The main features of the Dialog Boxes used in Visual Studio MFC C++ appliations. How to

create, display and close them? The communication between the dialog box shown on the

screen and the dialog box object instance. What are the most frequent dialog controls and how

to use them?

12. The features of the ODBC database connection library: data sources, connection string, etc.

How to use different data sources (dBase, Excel, MS Access, Oracle, etc.) in Visual Studio MFC

C++ Applications, and the role of the CRecordset class?

*Computer Vision*

13. Single view geometry (absolute conic and its image, vanishing point and line, orthocenter

theorem, calibration).

14. Stereo (Epipolar geometry, fundamental matrix, essential matrix, computation of the

fundamental matrix).

15. 3D reconstruction (Disparity and depth, stereo correspondence, projective reconstruction

theorem, Stratified reconstruction).

16. Motion (3D motion and motion field, motion parallax, optical flow and its computation, aperture

problem, image brightness constancy equation, tracking as probabilistic inference).

*Embedded Systems*

17. Debugging non-PC-based embedded systems (software and hardware debugging methods,

their advantages and disadvantages).

18. Real-time programming (soft and hard real-time systems; how to make a non-real-time system

to a real-time one).

19. Rasberry Pi programming (controlling peripherals and simple circuits via GPIO pins using

Python)

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*Distributed Application Development*

20. Data type system and the control structures of the C# language, comparing them to C++ and

Java. Compliation of Windows Forms and Console applications, application of .NET assemblies

and ANSI C dynamic link libraries.

21. The elements of Windows Forms application programming, types of Forms and controls, how to

create and dispose them. The features of the most frequent controls like textbox, richeditbox,

pushbutton, listbox, listview.

22. The development of .NET C# Windows Forms applications, menus, MDI applications, and

serialization. Application of Resources, Settings, the role of the CultureInfo class.

23. The development of applications based on database services. How to execute database SQL

queries and display the results on Windows Forms? Implementing binding between data table

columns and controls, the BindingNavigator class.

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