University of Ljubljana
Faculty of Computer and Information Science

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Catalogue of Knowledge

for enrolment into the second cycle Master's study programme

Multimedia

2025/2026

CATALOGUE OF KNOWLEDGE FOR THE SELECTION EXAM FOR ENROLMENT IN THE MASTER'S PROGRAMME MULTIMEDIA

The catalogue of knowledge covers the knowledge required for enrolment in the Multimedia master's programme.

This document sets out the fields covered by the questions in the selection examination, which will serve as the basis for candidate selection in the event of limited enrolment. In the event of limited enrolment, candidates will be selected based on:

- first-cycle studies grade point average (20%),
- selection exam results (80%).

Programming

- basics of object-oriented and procedural programming
- programme constructs for flow control (branching, loops, programme structures)
- iteration and recursion
- basic data types (whole numbers, real numbers, series, logical values) and operators
- simple editing algorithms

V. Mahnič, L. Fürst, I. Rožanc: Java skozi primere, Bi-TIM, 2008 or J. Farrell: Java Programming, Seventh Edition, Course Technology
T. Dobravec: abC, Faculty of Computer and Information Science, 2010 or B. W. Kernighan, D. Ritchie: The C Programming Language

Mathematics

- complete induction, complex numbers, polarity record, sequences, type aggregation
- functions of real variants, differentiation and partial differentiation, gradient, optimisation, integral
- analytical geometry in R^3 (vectors, dot product, vector product, line equation, plane equation, projections, distances)
- matrix account, proprietary matrix values, matrix determinants, systems of linear equations

James Stewart: Calculus, early transcendentals, chapters 1-8, 11, 12, 14
B. Orel: Linearna algebra, ZaFri 2013 or G. Strang: Introduction to linear algebra

Multimedia content

- basics of multimedia content coverage
- properties of multimedia content digitalisation
- types and formats of multimedia content
- technologies of multimedia content transfer

John Watkinson, The MPEG handbook: MPEG1, MPEG2, MPEG4 Part10/H.264/AVC included, second edition 2004, Focal Press
E.P.J. Tozer, Broadcast Engineer's Reference Book, 2004
H. Benoit, Digital Television: Satellite, Cable, Terrestrial, IPTV, Mobile TV in the DVB Framework, Focal Press

Multimedia technologies

- primary web standards, primary web server concepts, basics of XML/JSON, web services
- planning a user interface
- basics of planning interactions

R. W. Sebesta: Programming the World Wide Web, Pearson Education
R. Beale, Alan J. Dix, Janet E. Finlay, Gregory D. Abowd: Human-computer Interaction, Prentice Hall

Extracting knowledge from data

- measuring distances, techniques for detecting groups in data
- criterion function, numerical optimisation through method of gradient descent
- basic predictive models for regression and classification, e.g. linear and logistical regression, regularisation, classification and regression trees and forests
- recommendation systems with group filtering, analysis of shopping baskets and linking rules

P.N. Tan, Steinbach, M., and Kumar, V. (2006) Introduction to Data Mining, Pearson Education

Samples of assignments for the selection exam for enrolment in the master's programme
Multimedia

1. System of equations

$$\begin{aligned} 2x + 2y + 3z + 4w &= 5 \\ x + 2z + w &= 3 \\ -2y - z + 2w &= 1, \end{aligned}$$

where x,y,z,w are $\in \mathbb{R}$,

   (a) has infinite solutions,
   (b) has precisely one solution,
   (c) has no solution,
   (d) none of the above.

2. What is the lowest value of the function $f(x) = x^4 - 2x^2$ at the interval [0,2]?

   (a) $-\sqrt{2}$
   (b) -1
   (c) 0
   (d) 1

3. Which of the following statements is not true?

   (a) any recursive programme can be transformed into an iterative one
   (b) implementing recursive programmes is usually slower than iterative ones
   (c) tail recursion can simply be replaced with a loop
   (d) interpreted programme languages cannot implement recursive programmes

4. The programme below is the sum of every second number in the list of numbers. At two marked points the programme is missing two parts of the programme code, marked as XXX and YYY:

```
float* sum2(float* list, int start, int len)
{
    if (XXX > len-1)
        return YYY;
    else
        return list[start] + sum2(list, start+2);
}

example of call: sum2([1, 2, 3, 4, 5, 6, 7, 8, 9, 10],0,10);
```

Which of the following supplements to the points XXX and YYY are correct so that the programme will function as shown?

(a) XXX = start+2, YYY = 0

(b) XXX = start+2, YYY = list[start]

(c) XXX = start, YYY = 0

(d) XXX = start, YYY = list[start]

5. Which decimal number represents the binary number 00111100?

(a) 30

(b) 60

(c) 90

(d) 120

6. How do you describe data stored in a XML file?

(a) Data does not need to be specifically described, you just look at their values

(b) Data is described in a XSL file

(c) Data is described in the part of the XML file marked `description`

(d) Data is described in a DTD file

7. In order to build a predictive model from data, we use logistical regression. We compare models obtained without regularisation and with regularisation. In comparison with the non-regularised model, the one where we used regularisation has:

(a) higher parameter values and matches the train set more

(b) higher parameter values and matches the train set less

(c) regularisation does not affect the values of the model parameters and the matching of the model

(d) lower parameter values and matches the train set more

(e) lower parameter values and matches the train set less

8. The function is given $y(\theta_0, \theta_1) = (\theta_0 - 3)^2 + (\theta_1 - 5)^2$. By means of a gradient descent we seek the values of the function parameters $y(\theta_0, \theta_1)$where that function has a minimum. The starting values of the parameters are set at $[\theta_0, \theta_1]^T = [1.1]^T$. The training rate is set at 0.1. What is the value of the parameters after the first step in the gradient descent, that is, after the value of the parameters is first refreshed through the gradient descent.

(a) $[1.2, 5.6]^T$

(b) $[1.6, 1.2]^T$

(c) $[3, 5]^T$

(d) $[1.4,1.8]^T$

(e) $[-3, -5]^T$

9. The criterion function for the selected predictive model in Python programming language is implemented through the following function `j(theta, x, y)`:

```
def h(theta, x):
    return 1. / (1 + np.exp(-x.dot(theta)))

def j(theta, x, y):
    return -(y.dot(np.log(h(theta, x))) + (1-y).dot(np.log(1-h(theta, x))))
```

Which predictive model uses this criterion function?

(a) linear regression
(b) random forest
(c) logistic regression
(d) matrix factorisation
(e) classification tree

10. What are the typical transfer speeds for transferring high-definition video (HD 720p) using H.264 codec?

(a) 5-10 Mbit/s
(b) 10-15 Mbit/s
(c) 2-5 Mbit/s
(d) 15-20 Mbit/s

11. In which field of multimedia content do you encounter the multimedia content labels 4:2:2, 4:2:0, 4:1:1, etc?

(a) Audio signal sampling – sampling depending on frequency bands
(b) Image sampling – frequency of sampling colour and luminance visual elements
(c) Labelling the sequence of image frames I, B, P in video coding
(d) Labelling the quality of various profiles of audio and video streaming in the MPEG-DASH standard