

## **Attachment 4**

### **Method and program of personal preparation assessment test**

The admission test consists of a multiple choice test comprising 36 questions; for each question the candidate must indicate only one solution among 3 possibilities. One and only one of the answers suggested is correct. The test is passed if at least 24 correct answers are given.

Test duration will be communicated by the Commission.

The subject areas of the questions are defined by the following list of topics.

#### **AUTOMATICA (9 questions)**

##### **Syllabus:**

- 1) State-space representation of linear systems: basic properties and stability analysis
- 2) Linearization of a nonlinear system around an equilibrium
- 3) Transfer function: definition and properties
- 4) Step response of first and second order linear systems
- 5) Frequency response: definition and properties
- 6) Bode plots and their asymptotic approximations
- 7) Block diagrams: definition and transformations. Structure of a control system.
- 8) Stability of closed-loop systems: Bode stability criterion and characteristic equation
- 9) Sensitivity and complementary sensitivity functions: definitions and properties
- 10) Performance analysis of closed-loop systems

#### **DATA BASES & OPERATING SYSTEMS (9 questions)**

##### **Syllabus:**

- 1) DBMS and data bases: architecture, schemes, data models
- 2) The relational model: relations, keys, constraints, functional dependencies
- 3) Relational algebra: set and relational operators, expressions
- 4) The conceptual data model Entity Relationship Attribute
- 5) The SQL language
- 6) Process Scheduling
- 7) Process Synchronization
- 8) Virtual memory
- 9) Security
- 10) Deadlock

#### **PROGRAMMING (9 questions)**

##### **Syllabus:**

- 1) Algorithms and flowcharts
- 2) Data types of the C language
- 3) The recursion
- 4) Numerical data representation, conversion and processing
- 5) The registers of a processing unit (CPU)
- 6) Data types, classes and objects: definitions and usage in the Object Oriented Programming
- 7) Variables, allocation, scope and lifetime
- 8) Notions of methods overloading and overriding
- 9) Software development techniques (cascade, incremental, prototyping)
- 10) Methodologies for design and analysis of software applications

## **HARDWARE SYSTEMS AND COMPUTER NETWORKS**

- 1) Computers arithmetic and architecture
- 2) CPU architecture
- 3) MIPS assembly language and correspondent SPIM development environment
- 4) Computer networks and Internet: circuit switching and packet switching, protocol layers and service models, TCP/IP model, delay and loss in packet-switched networks
- 5) Internet routing: IPv4 addressing, IPv4 datagram format, routing algorithms
- 6) Transport layer: multiplexing and demultiplexing, UDP and TCP protocols, flow control, and congestion control in TCP
- 7) Optimum two-level combinational network synthesis for incompletely specified functions
- 8) Analysis of an asynchronous sequential network; analysis of a synchronous sequential network
- 9) Fixed point relative number representations and their conversion among different formats
- 10) Fixed point relative number multiplication and division algorithms

## **REFERENCES**

### **AUTOMATICA:**

P. Bolzern, R. Scattolini, N. Schiavoni, "Fondamenti di controlli automatici", McGraw-Hill  
G. Franklin, J.D. Powell, Abbas Emami-Naein, "Feedback Control of Dynamic Systems" Prentice Hall; 5 edition (Nov 10 2005)

### **DATA BASES & OPERATING SYSTEMS**

P. Atzeni, S. Ceri, S. Paraboschi, R. Torlone. Basi di dati: Modelli e linguaggi di interrogazione. McGraw Hill, 3za edizione (2009).

James R. Groff, Paul N. Weinberg. SQL La Guida Completa 2/ed con CDROM. McGraw Hill.  
Testo completo su SQL..

Silberschatz, Avi; Galvin, Peter; Gagne, Greg (2008). Operating Systems Concepts. John Wiley & Sons.

**PROGRAMMING:** Prof. Barili: Appunti alle lezioni, disponibili su  
<http://www.unipv.it/abarili/didattica/f2/index.htm>).

K. Arnold, J. Gosling, D. Holmes. *Il Linguaggio Java*, Pearson.

I. Sommerville. *Ingegneria del Software*, Pearson

Tullio Facchinetti, Cristiana Larizza, Alessandro Rubini, "Dalla A alla Z passando per C", Biblioteca Delle Scienze, Pavia, 2009.

## **HARDWARE SYSTEMS AND COMPUTER NETWORKS**

D.A. Patterson, J.L. Hennessy. Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann.

J.F. Kurose, K.W. Ross. Computer Networking: A Top-Down Approach, Pearson.