# Example questions and sample answers
# for second-cycle qualification test

## 1 Programming languages and techniques

**1**. How to calculate the length of the text passed as an argument to the following function?

```
void foo(const char *txt){
    ...
}
```

a) txt.length()

**2**. What can you say about the following declaration?

```
int t[10]={1,2,[4]=1};
```

a) According to C99 standard it will create an array containing 10 elements, of which 7 will have value of 0.

**3**. How to calculate the length of the array in the function foo () ?

```
void foo(double t[]){
    // length of the array t?
}
```

a) The length of the array will be stored in the `len` variable, after executing the following code:

```
int len;
for(len=0; t[len]; len++);
```

**4**. Which implementation of a function that returns an array is correct?
a)

```
int * getTable(int *tab)
{
    return tab;
}
```

**5**. Assuming that the size of `char` is one byte, `short` is two bytes, and `double` is eight bytes, what is the value of the expression `sizeof (x)`, where `x` is a variable of the following structure type, when using 32-byte compiler with standard settings?

```
struct {
        char c;
        short i;
        double d;
} x;
```

a) 4+4+8=16

**6**. Analyze the following declaration.

```
int t[10];
int *p1=&t[0];
int *p2=&t[8];
```

Which statements are **true** (assume that you are using a 32-bit compiler)?
a) The following instruction will print 8.

```
printf("%d\n",p2-p1);
```

**7.** Examine the following declaration in C:

```
int (*x)(int,int);
```

a) The variable `x` is a pointer to a function having two arguments of type `int`.

**8.** Which statements related to the operators in the C/C++ language are correct:
a) For integer variables `x` and `y` having non-zero values, the statement

```
x & y
```

may be equal to 0, while

```
x && y
```

always has a non-zero value.

**9.** Which statements about `static` modifier in C/C ++ are correct :
a) In a function declared with the `static` modifier only variables declared as `static` can be used.

**10.** Using the C language calling convention known as __cdecl it is possible to implement functions with a variable number of arguments, like printf().
a) In the the generated code of function call the arguments are placed on the stack from the end. Thereby, the first call argument is placed the top of the stack and examining its contents, it is possible to determine the expected number of arguments used in the call.

**11.** How an array is passed as a function parameter in C, e.g.:

```
int main(int argc, char* argv[]){
    //...
}
```

a) The first element of the array is placed on the stack.

**12.** Which statements related to memory allocation in C and C++ are true?
a) Memory allocation for variables declared with the modifier `static` occurs before the start of the program.

**13.**
Which of the following statements related to references in the C++ language are correct?
a) After execution of the following code

```
int t[]={1,2,3,4};
int&r = t[0];
r+=2;
```

the reference `r` will point to the array element at index 2.

**14.** During the execution of the following instruction in C++:

```
A*ptr = new A();
```

an exception was generated. Which of the causes are plausible:
a) An exception was generated during the execution of the constructor .

**15.** Analyze the following snippet of C++ code, in which there the « operator is called

```
A a;
std::cout<<a;
```

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Which of the following implementations of the « operator is correct (sample code will be compiled and executed)?

a) As a function that returns a reference to the stream:

```
std::ostream& std::ostream&operator <<( std::ostream&os, const A&a){...}
```

**16.** The following function template was defined:

```
template<class T>
T suma(T*table,int size)
{
  T t=T();
  for(int i=0;i<size;i++)t+=table[i];
  return t;
}
```

Template instantiation process involves replacing the types and variables of template parameters by specific types and values, and then the generation of the target code. What assumptions must meet the type `T` to make the template instantiation possible?

a) A parameter of the template instantiation can be a class for which += operator is defined as a function, e.g.:

```
A&operator+=(A&,const A&){...}
```

**17.** Class `B` stores pointers to objects of class `A` in the `vector` container from the C++ standard library (STL)

```
class A{...};
class B{public:
      std::vector<A*> v;
      void add(A&a){v.push_back(new A(a));}
      ~B();
};
```

Which of the destructor implementations are correct (can be compiled, does not lead to a runtime error or memory leaks)?

a)

```
B::~B(){
      for(std::vector<A*>::iterator i=v.begin();
      i!=v.end();i++)delete *i;
}
```

**18.** The `set<T>` template defined in the C++ standard library (STL) stores elements in a tree structure. Which of the listed below data types may be used as an instantiation parameter of the `set<T>` template ?

a)

```
class A{public:
      bool operator==(const A&a)const;
};
```

**19.** Which of the following statements related to copy constructors and assignment operators in C++ are correct?

a) When executing the instruction

```
std:string a="text";
```

first the constructor `std:string()`, which initiates the object with an empty text, is called and then the assignment operator, which sets its value to "text" .

**20.** Implementations of overloaded C++ operators should reflect the semantics of operations on built-in types. Given this requirement, which of the operator implementation for the declared below class `X` is correct?

```
1  class X
2  {
3  friend X&operator+=(X&a, const X&b);
4          int x;
5  public:
6          X(int _x=0):x(_x){}
7          X&operator+(const X&o);
8          X&operator++(int);
9          X&operator-=(const X&o);
10 };
```

a)

```
1  X&X::operator+(const X&o){x=x+o.x;return *this;}
```

**21**.    Which of the following operators in C++ allow to access information about the type of the object during the runtime:
a)  typeid

**22**.    Two classes were declared as follows:

```
1  class A{
2  public:
3      virtual void f(){printf("VA ");}
4      void g(){printf("A ");}
5  };
6
7  class B:public A{
8  public:
9      void f(){printf("VB ");}
10     void g(){printf("B ");}
11 };
```

and two objects were created:

```
1      A* a1 = new A();
2      A* a2 = new B();
```

Which of the statements are true?
a)  The following call

```
1      a1->g();
2      a2->g();
```

will result in printing A A

# 2   Introduction to UNIX system

**23**.   The basic Unix architecture includes the following:
a)  TCP/IP stack

**24**.   In the Unix file system:
a)  the parent directory is represented as /

**25**.   The 453 access rights of the file allow
a)  the members of the group executing the file

**26**.   In the Unix file system:
a)  files that change often in the */var* directory

**27**.   Which of the following statements are true?
a)  user account information is stored in */etc/passwd* and */etc/shadow* files

**28**.   When managing file systems
a)  file system can be checked using **checkfs**

**29**.   During the start/boot of the Unix system
a)  the first created process is Init

**30**.   Processes in the Unix system
a)  their scheduling priorities can be freely changed by their owner

**31**.   Examples of interprocess communication in Unix are
a)  pipes

**32**.   Logging events in Unix:
a)  uses the *Logger* package

**33**.   When configuring network communication in Unix:
a)  the **route** is used to configure routing

**34**.   Bash configuration files in Unix are:
a)  *.bash_logout* in the home directory – loaded when closing the shell

**35**.    As a result of which of the following commands, the members of the group to which the file belongs will lose the right to modify the file
a)  `chmod o+x,g-w plik`

**36**.   Which of the following statements about the signals sent to the Unix processes are correct
a)  SIGKILL can not be caught by the process

**37**.   When configuring network in the Unix system:
a)  reconfiguration of the network interface requires administrator privileges

# 3 Introduction to computer graphics

**38**.    What for is the object rendering in computer graphics?
a) To transform structure from 3D to 2D.

**39**.    Specify which sequence of actions in graphics pipeline is correct.
a) Modelling transformation; Viewing transformation; Projection transformation; Clipping; Per-vertex lighting; Texturing; Scan conversion or rasterization; Display.

**40**.    What are basic types of modern computer graphics?
a) Adobe, Internet, Blender, Flash.

**41**.    Specify differences between OpenGL and Direct3D?
a) There is no essential difference.

**42**.    What are 3 basic transformations in computer graphics and what mathematics is used to compute them?
a) Scaling, Rotation, Translation, are computed with matrix operations.

**43**.    What is Ray Tracing?
a) It is computer graphics card.

**44**.    What is the common shortcut for graphics processor?
a) FPU

**45**.    What is fractal?
a) It is kind of texture.

**46**.    What is meaning of NURBS?
a) It is an algorithm to compute transparency.

**47**.    What is Z-buffering?
a) It is method of objects texturing.

# 4 Object-oriented programming

**48**.    To check, if two objects of *String* type have the same content, one can:
a) use `String.strcmp()` method

**49**.    Which of the following code snippets allow to check, if an object referenced by `xyz` is of the `XYZ` type.
a)

```
if(xyz instanceof XYZ)
```

**50**.    An array is declared as following:

```
int tab[] = new int[]{3,2,1,0};
```

Which of the following code snippets will print out its elements correctly:
a)

```
for(int i=0;tab[i]!=null;i++)
    System.out.println(tab[i]+" ");
```

**51**.    Analyze the following code:

```
        loop: for(int i=0;i<3;i++){
           for(int j=0;j<5;j++){
              System.out.print(i+j);
              if(j==1)break loop;
           }
        }
```

What will be printed out:
a) 0011223

**52**.    Which of the following statements characterizing class properties are **true**:
a)  An abstract class declares or inherits an abstract method (e.g. from another class or interface), but does not provide its implementation.

**53**.    Which of the following sentences characterizing properties of Java classes are **true**:
a)  A class can implement multiple interfaces.

**54**.    Which of the following statements related to access modifiers in the Java programming language are **true** .
a)  An access to `protected` members of a class is allowed only for subclasses.

**55**.    Which combinations of method modifiers are allowed:
a) `abstract synchronized`

**56**.    Which of the following statements are **true**:
a)  All arrays are cloneable (implement the `Cloneable` interface)

**57**.    How objects are deleted on the Java platform?
a)  By passing a reference to the object that should be deleted to `System.gc()` method.

**58**.    Which of the following statements related to class constructors are **true**
a)  A constructor is called, while an object is created with use of the `new` operator.

**59**.    Which of the following statements related to exceptions in Java language are **true**?
a)  If a method generates an exception that is not a subclass of `RuntimeException`, it has to declare it as being thrown or catch it.

**60**.    Which of the statements related to generic types are **true**?

a) It is not possible to create arrays of parametrized types.

**61**.　　Which of the following statements related to nested and inner classes are **true** for the Java programming language?

a) A reference `Outer.this` is available in methods of a nested class (declared with the `static` keyword), where `Outer` is the name of an outer class.

**62**.　　Which of the following statements related to interfaces are **true** for the Java programming language?

a) Interface definition may contain inner or nested classes.

**63**.　　Which of the following statements related to threads are **true** for Java programming language.

a) A *demon* is a thread that has terminated.

**64**.　　Which of the following statements related to threads in Java programming language are **true**?

a) It is recommended to terminate a thread execution by returning from the `run()` methods

**65**.　　Which of the following statements related to monitors in the Java programming language are **true**?

a) A thread executing a `synchronized` method does not need to be a monitor owner.

**66**.

Which of the following statements related to Java AWT library are **true**?

a) Layout and sizes of components are saved in an XML file.

**67**.　　Which of the following statements related to event handling in AWT library are **true**.

a) Instructions for events handling use `catch` keyword.

**68**.　　Which of the following statements related to the Swing library are **true**.

a) Operations of Swing components (eg. displaying) are more efficient because instead of being implemented in the Java language, they are supported by system functions implemented in native code.

**69**.　　Model of a Swing component denotes:

a) Encoded reactions to events in the form of a transition system.

# 5 Computer architectures

**70**. ALU
a) Must be a sequential system

**71**. Using the FPGA system is possible to perform
a) None of the mentioned above

**72**. Combinational system is
a) A system which may be constructed of only logic gates

**73**. Sequential system is
a) A system which components may be logic gates joined with jk flip-flops

**74**. Random-access memory (RAM)
a) Can be constructed from NAND gates without feedbacks

**75**. Dual-port memory ram
a) Is a memory ram with two interfaces allowing undependably to get access to the same memory cells

**76**. Counter
a) Can be constructed by means of FPGA but only asynchronous one

**77**. Processor
a) None of the mentioned above

**78**. Instruction set of processor
a) The component of instruction set is always multiplication

**79**. Graphics card
a) Can be combinational system

**80**. Keyboard
a) Communication with using of ps2 is an asynchronous one direction communication

**81**. Program counter
a) Is a counter with parallel input being used by every jump instructions

**82**. Instruction of unconditional jump of processor
a) Does not influence on the state of program counter of the processor

**83**. Instruction of conditional jump of processor
a) None of the mentioned above

**84**. The processor's instruction performing adding of two numbers
a) Causes adding of two numbers, the result is saved in instruction register

**85**. In processor which uses the pipelining
a) The same stage of two following instructions can be executed at the same moment

**86**. In superscalar processor
a) The same stage of two following instructions can be executed at the same moment

**87**. One-bit adder
a) Has only one data input, second input of bit carried in from the previous less-significant position and two outputs: sum and overflow

**88**. Instruction register

a) Stores instruction's code loaded from program's memory

**89**.    The examples of combinational systems are
a) Shift register and decoder

**90**.    The examples of sequential systems are
a) Two direction counter and shift register

**91**.    Asynchronous communication
a) Sending and receiving systems must be asynchronous systems

# 6 Numerical methods

**92.** In a hypothetical binary floating-point arithmetic system, negative numbers are represented within an interval: $< -b, -a >$. We want to represent a namber smaller than -b and having infinite continued fraction so we use instead nearest number represented in the considered system. What kind of numerical error we obtain?
a) Arithmetic underflow

**93.** A necessary and sufficient convergence condition for an iterative method solving a linear system of equations (like Jacobi method or Gauss–Seidel method) is:
a) The spectral radius of the iteration matrix is more than 1.

**94.** Which of the following methods are direct methods for solving linear systems?
a) Gaussian elimination

**95.** Which of the following methods use properties of polynomial interpolation.
a) Solving linear systems with the use of iterative methods

**96.** The condition numbers of Hilbert matrices are very high, so we can say that:
a) The Hilbert matrices are well-conditioned matrices.

**97.** Which of the following conditions must a cubic spline interpolant satisfy (at the interpolation points)?
a) The interpolating function is a continuous function.

**98.** Which of the following statements (regarding polynomial interpolation using a monomial basis) are true?
a) Polynomial interpolation with monomial basis is a ill-conditioned problem.

**99.** How do we call errors that arises from taking a finite number of steps in a computation to approximate an infinite process?
a) Rounding errors

**100.** If a small change in the input argument results in a small change of the output value of the function:
a) The problem is well-conditioned.

**101.** The bisection method (root-finding method) is guaranteed to converge to a root of function $f(x)$ in interval $[a, b]$ if:
a) First and second derivative of a function $f(x)$ has constant sign on the interval $[a, b]$.

**102.** Newton method for finding roots of function $f(x)$ in interval $[a, b]$, sufficiently close to the root, has the rate of convergence:
a) Qubic

**103.** In numerical analysis, the Newton–Cotes quadrature rules are a group of formulae for numerical integration. Which of the following methods/rules belongs to group of basic Newton–Cotes quadrature.
a) Romberg integration method

**104.** Runge's phenomenon is a problem that occurs in which of following interpolation methods?
a) Interpolation based on Lagrange polynomials and using nodes that are distributed equidistant on the interval.

**105.** In linear algebra, Gaussian elimination is an algorithm for solving systems of linear equations. Which of the following statements regarding the Gaussian elimination are true?
a) The Gaussian elimination is an iteration method.

**106.** To prevent or minimise Runge's phenomenon in the interpolation task one can apply:
a) Spline interpolation rather then interpolation based on Lagrange polynomials

# 7 Numerical analysis and system simulation

**107**.      Consider following conditions in initial value problem (IVP) for the differential equation $\mathbf{y}'(t) = f(t, \mathbf{y}(t))$, $f\colon \Omega \subset \mathbb{R} \times \mathbb{R}^n \to \mathbb{R}^n$, $t \in [a, b]$, $\mathbf{y} = [y_1, y_2, \ldots, y_n]^\intercal$. Which of them is(are) correctly formulated?
a) $n = 2, c = (a + b)/2, y_{10} = y_1(c), y_{20} = y_2(c)$.

**108**.   Differential equations can be represented as block diagrams. Which of following SIMULINK® diagrams represent(s) the differential equation $y'' - 2y' + 7y = 3\sin(5t) - 1$?
a)
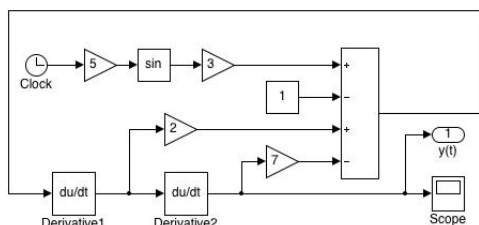


**109**.   Which of the following statements about numerical methods for initial value problems (IVP) in ordinary differential equations (ODE) is(are) true?
a) Adams-Bashforth 2nd order method is a multistep method.

**110**.      Numerical solution of initial value problem in ordinary differential equations. Which of following methods is(are) a self-starting method:
a) Multistep (e.g. Adams-Bashforth) 4th order method,

**111**.   Consider a case of using Euler's method to solve an initial value problem $y'(t) = f(t, y(t)), y_0 = y(0)$. Let us assume that numerical error of each arithmetic operation is equal to zero. Which of following sentences is(are) true?
a) If analytical solution is a linear function of independent variable $t$, than the Euler's method gives exact solution.

**112**.   Consider predictor-corrector (PECE) methods for initial value problems. Which of following sentences is(are) true: Algorithms of this type
a) do not use implicit methods.

**113**.   Which of the following statements about Runge-Kutta (RK) methods for initial value problems (IVP) in ordinary differential equations (ODE) is(are) true?
a) An explicit 3-stage, 3th-order RK method could be constructed.

**114**.   Explicit Runge-Kutta (ERK) methods for initial value problems (IVP) in ordinary differential equations (ODE). Let us consider $n$-stages ERK methods (i.e. $n$ denotes the number of stages). Let $r_n$ denotes the maximal available order of the method from among $n$-stages methods. Which of following relations is(are) true for any $n$?
a) $r_n \geq n$.

**115**.   Which of following sentences about static optimization algorithms is(are) true?
a) The steepest descent method needs computing of Hessian.

**116**.   Discrete Least-Squares Approximation.
Experimental data $y_i$, $i = 0, 1, \ldots, n$ are measured for $n+1$ values of independent variable $x_i$, $i = 0, 1, \ldots, n+1$ and $x_{i-1} < x_i$, $i = 1, 2, \ldots, n$. The dependency of $y$ on $x$ is approximated by polynomial $W_m(x) = \sum_{j=0}^m a_{j,m} x^j$. $E_m$ denotes the approximation error, i.e. a distance between the set of approximated points and the best approximation polynomial. Which of following implications is(are) true?
a) $m > n \Rightarrow E_m < 0$

**117.** Discrete Least-Squares Approximation.

Experimental data $y_i$, $i = 0, 1, \ldots, n$ are measured for $n+1$ values of independent variable $x_i$, $i = 0, 1, \ldots, n+1$. The dependency of $y$ on $x$ is approximated by polynomial $W_m(x) = \sum_{j=0}^{m} a_{j,m} x^j$. Consider 3 approaches to calculating the approximation error $E_m$.

1. $E_m = \min_{a_{0,m}, a_{1,m}, \ldots, a_{m,m}} \sum_{i=0}^{n} |y_i - W_m(x_i)|$

2. $E_m = \min_{a_{0,m}, a_{1,m}, \ldots, a_{m,m}} \sum_{i=0}^{n} (y_i - W_m(x_i))^2$

3. $E_m = \min_{a_{0,m}, a_{1,m}, \ldots, a_{m,m}} \max_{i=0,\ldots,n} |y_i - W_m(x_i)|$

Which of following statement is(are) true? The problem of finding the coefficients $a_{j.m}$ of the best approximation polynomial can be reduced to solving a system of linear equations
a) in the ceases 1, 2, 3.

**118.** Three approximation functions are found for the same experimental data

$$
\begin{array}{c|ccc}
i & 0 & 1 & 2 \\
\hline
x_i & 2 & 4 & 6 \\
y_i & 1 & 2 & 1
\end{array}.
$$

Approximation function formula has a form $f_k(x) = a_k x + b_k$ in all 3 cases (for $k = 1, 2, 3$), but 3 different error measures has been used,

1. for $k = 1$: $\min_{a_1,b_1} \sum_{i=0}^{2} |y_i - f_1(x_i)|$,

2. for $k = 2$: $\min_{a_2,b_2} \sum_{i=0}^{2} (y_i - f_2(x_i))^2$,

3. for $k = 3$: $\min_{a_3,b_3} \max_{i=0,1,2} |y_i - f_3(x_i)|$.

Which of following solutions is(are) correct?
a) $a_1 = a_2 = a_3 = 0$, $b_1 = 1$, $b_2 = \frac{3}{2}$, $b_3 = \frac{4}{3}$.

**119.** Numerical methods in static optimization.

Consider a quadratic function in $n$ variables $f : \mathbb{R}^n \to \mathbb{R}$, (in vector notation $\mathbf{x} = (x_1, x_2, \ldots, x_n)^\mathsf{T}$)

$$f(\mathbf{x}) = \mathbf{x}^\mathsf{T} A \mathbf{x} + \mathbf{b}^\mathsf{T} \mathbf{x} + c.$$

$A$ denotes a positive definite matrix $n \times n$ and $\mathbf{b}$ a vector $n \times 1$. Their entries are constant. $c$ is a constant scalar. Function $f$ has a minimum in $\mathbf{x}_{\min}$. Let us assume that in order to find the minimum $\mathbf{x}_{\min}$ we can use 3 methods: Nelder-Mead simplex, steepest descent method or Newton method. We start with any initial point $\mathbf{x}_0 \in \mathbb{R}^n$, $\mathbf{x}_0 \neq \mathbf{x}_{\min}$. Which of following sentences is(are) true?
a) All 3 specified above methods guarantee that the minimum $\mathbf{x}_{\min}$ will be found in the first step.

**120.** Discrete Least-Squares Approximation.

Consider a problem of finding the parameters $a_i$ of the best approximation function (the class of function is fixed). Can such a problem be reduced to solving a system of linear equations? Which of following answers is(are) correct?
a) Yes, but if and only if the approximation function is linear in independent variable.

**121.** Discrete Approximation.

Consider a series of 3 approximation task. Each of them (denoted by the index $k = 1, 2, 3$) is to approximate the same set of points $P = \{(x_i, y_i) | i = 0, 1, \ldots, n\}$ by a function $f^{(k)}(x; a_{k,j} | j = 0, 1, \ldots, m)$ in independent variable $x$ with parameters $a_{k,j}$, $j = 0, 1, \ldots, m$. For each values of index $k$ the number $m$ is the same, but 3 different measures of approximation quality:

1. for $k = 1$: $\min_{a_{1,0}, \ldots, a_{1,m}} \sum_{i=0}^{n} |y_i - f^{(1)}(x_i)|$,

2. for $k = 2$: $\min_{a_{2,0}, \ldots, a_{2,m}} \sum_{i=0}^{n} (y_i - f^{(2)}(x_i))^2$

13

3. for $k = 3:$  $\min_{a_{3,0},\ldots,a_{3,m}} \max_{i=0,1,\ldots,n} |y_i - f^{(3)}(x_i)|$.

Let $\Delta_{\max}^{(k)}$ denotes the distance between approximation function $f^{(k)}$ and the set of points $P$ in infinity norm, i.e. $\Delta_{\max}^{(k)} = \max_{i=0,\ldots,n} |y_i - f^{(k)}(x_i)|$, $k = 1, 2, 3$.. Which of following relations is(are) true?

a) $\Delta_{\max}^{(1)} \leq \Delta_{\max}^{(2)}$,

# 8   Web languages and technologies

**122**.      Select correct statements. A packet path between two nodes in the Internet (a list of nodes the packet visits):

a)  is not limited

**123**.    A DNS translates

a)  user names to IP addresses

**124**.    Select correct statements. The HTTP 1.1 protocol

a)  enables data transfers below 2kB only

**125**.    Which tools can be used to directly communicate with a web server?

a)  host

**126**.    Which statements regarding XHTML 1.0 Strict code given below are true?

```
<p><a  href=http ://www. agh . edu . pl ><br ></p>
```

a)  It is valid.

**127**.    There is the following XHTML 1.0 Strict code.

```
<img  src=" http ://www. agh . edu . pl / i . jpg "
      width ="320"
      height ="240"
      alt =" logo  AGH"  />
```

The image *i.jpg* is 1024x768. Which statements are true?

a)  The browser will scale down the image.

**128**.    How many CSS resources for a single XHTML 1.0 Strict document there could be?

a)  Not more than one.

**129**.    Choose correct statements regarding the following CSS 2.1 code.

```
.nav > div {
  color:  white ;
  background:  #119500;
  float:  right ;
  width:  120px ;
  padding:  1px ;
  font-size:  small ;
  border:  solid  red  1px ;
}
```

a)  It regards all *div* descendants of elements which belong to the *nav* class.

**130**.    Select correct statements in regard to the following PHP code.

```
$fp = fopen (" plik_do_blokowania ", "r +");
if  ( flock ($fp ,  LOCK_EX)) {
  processing ();
  flock ($fp ,  LOCK_UN);
} else {
  problem ();
}
fclose ($fp );
```

a) The *processing()* function is called within the critical section.

**131**.    There is a form given below which content is sent to a PHP script. Select correct statements.

```
<form action="skrypt.php" method="post"
          enctype="multipart/form-data">
      <p>
        <input type="file" name="plik" />
        <input type="text" name="comment" />
        <input type="submit" value="wyslij" />
      </p>
</form>
```

a) *$_FILES['plik']* holds the file content.

**132**.    What does the following code do?

```
<?php
$wiek=array('ala' => 12,'ela' => 22,'franek' => 54);
foreach ( $wiek as $k => $w )
   echo $k.'   '.$w."\n";
?>
```

a) There will be the *$wiek* array values on the standard output.

**133**.     How long would it take to run the following PHP code? It is assumed that the script is run as a web application at some URI and the PHP interpreter is run by a web server.

```
<?php
   echo 'start';
   sleep(6);
?>
```

a) At least 6 seconds, unless it exceeds the maximum execution time.

**134**.    Which of the following methods return an element indicated by a unique identifier in JavaScript?
a) *document.getElementById('form')*

**135**.     What is an outcome of the following JavaScript code if it is properly placed between other elements in a XHTML document?

```
car=new Array();
car[0]=new Object();
car[0].make='Fiat';
car[0].vin='123';
car[1]=new Object();
car[1].make='Ford';
car[1].vin='456';

for ( idx in car ) {
    for ( prop in car[idx] ) {
        document.write(car[idx][prop]);
    }
}
```

a) There will be a string *Fiat123Ford456* placed at the end of the document.

**136**.    Select correct statements regarding the following JavaScript code.

```
1  function updateAjax() {
2    xmlhttp = new XMLHttpRequest();
3    xmlhttp.onreadystatechange = function() {
4      if (xmlhttp.readyState==4 && xmlhttp.status==200) {
5        document.getElementById("stime").innerHTML=xmlhttp.responseText;
6      }
7    }
8    xmlhttp.open("GET","date.php",true);
9    xmlhttp.send();
10   window.setTimeout("updateAjax()",1000);
11 }
12 window.setTimeout("updateTime(); updateAjax();",5000);
```

a) After executing *updateAjax()* it will be rerun in 1 second.

**137**.  There is an XML document and a corresponding DTD. Select correct statements.
a) The DTD is not required to check if the document is well formed.

# 9 Operational Research and theory of computational complexity

**138**. Which of the following time complexities are exponential-time ones?
a) $\mathcal{O}(\log 10^n)$

**139**. Which of the following statements are false?
a) A number of leaves in a full $n$-ary tree depends exponentially on a distance between the root an a leaf.

**140**. What parameter is usually assumed as an upper limit in branch and bound algorithms?
a) Value of an objective function for the best solution being obtained so far

**141**. The various reproduction types are used in evolutionary algorithms. Which of them relies on selecting the best individuals from the drawn subsets?
a) Reward-based selection

**142**. To minimize the time required for completing a project represented by graph (network) the critical path method is used. How to describe this method?
a) Determining the sequential limitations of critical tasks

**143**.
For which of the basic techniques of evolutionary computations the mutation range is the subject to adaptation?
a) For genetic programming

**144**. The following primal problem is given:

$$\mathbf{c}^T\mathbf{x} \to \max, \mathbf{A} \cdot \mathbf{x} \le \mathbf{b}, \mathbf{x} \ge 0.$$

The corresponding dual problem is of the form:
a) $\mathbf{b}^T\mathbf{x} \to \min, \mathbf{A}^T \cdot \mathbf{y} \ge \mathbf{c}, \mathbf{x} \le 0.$

**145**. The bridge of a graph is:
a) The lowest number of graph nodes whose deletion makes this graph either unconnected or trivial

**146**.
What is the name of a subset $V' \subset V$ (where $V$ is a set of nodes of some graph $G$) such that each node $v \notin V'$ is a neighbor of some $u \in V'$?
a) Clique

**147**. What is the name of a job shop scheduling system in which each a job has to be processed by all machines in the same, strictly defined order?
a) General system

**148**.
In the simulated annealing algorithm some neighboring state $s'$ of the current base solution $s$ is drawn. What happens if $s'$ is worse than $s$?
a) $s'$ replaces $s$ if the parameter referred to as temperature is less than zero

**149**. In the computational complexity theory all decision problems which may be solved in a polynomial time by the non-deterministic Turing machine constitute certain class of problems. What is the name of this class?
a) Class P

**150**. Using the method of a dual program allows for:
a) Transition from a model described by a set of nonlinear equations to a linear model

**151**. Suppose we are given two algorithms, A and B. Their time complexities are $\mathcal{O}_A(n^3)$ and $\mathcal{O}_B((\log n)^3)$ respectively. Which one will terminate sooner assuming that both start at the same time and operate on identical input data.
a) B

**152**.    What is the purpose of using a penalty function in evolutionary algorithms?
a)  Decreasing a number of individuals in a population

# 10 Computer networks

**153**.     A version 4 IP broadcast address for IP network that includes host 110.104.1.10 and has a mask of 255.0.0.0, is:
a) 110.104.255.255

**154**.    An IP datagram field called "Time to live", that prevents from packet routing loops, has a value expressed in:
a) Time in seconds elapsed since packet forwarding process began.

**155**.     The name of frame used in IEEE 802.11 technology and send by an Access Point device for information broadcasting about wireless network, is:
a) Link

**156**.    UDP protocol port number identifier, send in each UDP datagram, has a bit-length of:
a) 24 bits

**157**.    An IPv6 value (together with mask) indicating all hosts in the Internet, is:
a) 0.0.0.0/0

**158**.     The IP routing rule called 'Longest prefix match' will cause, that IP datagram destination address of 200.200.200.1 in an IP routing table consisting prefixes (CIDR notation): 200.200.200.0/18, 200.200.200.0/20, 200.200.200.0/22, 200.200.200.0/24 will be fixed to:
a) 200.200.200.0/18

**159**.    The maximum IPv4 packet length (in bytes), is:
a) 1024

**160**.    MPLS (MultiProtocol Label Switching) router, that receives MPLS-labelled packets from another one, is called:
a) Downstream router

**161**.     iBGP (internal Border Gateway Protocol) router, that allows to reduce iBGPs sessions number between BGP routers (allows to avoid use of iBGP Full-mesh topology), is called:
a) BGP Mirror

**162**.    A number of CoS (Class of Service) classes, defined by a basic QoS (Quality of Service) mechanisms (IEEE 802.1p) in the Ethernet, is:
a) 8

**163**.     A variant of STP (Spanning Tree Protocol, IEEE 802.1d), that allows use of Ethernet VLAN (Virtual LAN) spanning tree aggregation (using the same spanning tree for whole group of VLANs), is called:
a) RSTP (Rapid Spanning Tree Protocol)

**164**.    Kinds (groups) of physical devices defined in a ZigBee technology, are:
a) ZigBee End Device, ZigBee Coordinator, ZigBee Router

**165**.    The name of routing information migration process between different dynamic IP routing protocols in IP routers is:
a) Redistribution

**166**.    Symbols (acronyms) for popular kinds of fiber-optics cable plugs in computer networks, are:
a) RT, RR, LT

**167**.    What is defined by the IEEE 802.1Q standard?
a) Private VLANs over Ethernet.

**168**.    A protocol, allowing remote host IP address translation to a host MAC address, is called:
a)  SLIP (Serial Line Internet Protocol)

**169**.    What kind of information is placed in Extended Unique Identifier (EUI) field of an IPv6 address?
a)  A host MAC address fulfilled with a 0xFFFE sequence.

**170**.     A default Administrative Distance value in an IP routing table (Cisco, Juniper, Helwett-Packard) for a RIP (Routing Information Protocol)-originated rules is:
a)  110

**171**.    In a Fibre Channel (deployed in SAN networks) a Switch Fabric port, capable of working in an Arbitrated loop topology, has a type of:
a)  N

**172**.    Two sub-layers defined inside ISO-OSI model layer 2, are:
a)  LLC (Logical Link Control) and MAC (Media Access Control)

**173**.    An Effective Isotropic Radiated Power (EIRP) of a wireless device transmitter (expressed in dBm) can be calculated from power in Watts with a use of following formula:
a)  EIRP = 1 / (P*1mW)

**174**.     A RACK standard network device height unit, equivalent to 1.75 inch (or about 44.45 mm), is marked with:
a)  F

**175**.    A kind of network area in an OSPF (Open Shortest Path First) dynamic IP routing protocol domain, which doesn't receive any kind of external IP routes, is called:
a)  NSSA

**176**.    A parameter called "Window size", transmitted in a TCP (Transmission Control Protocol) acknowledge-ment datagram, is used to:
a)  express a length of TCP datagram, it belongs to (in case of short TCP acknowledgement datagram it has no important meaning).

**177**.     Two kinds of network areas defined in an IS-IS (Intermediate System to Intermediate System) dynamic IP routing protocol, are:
a)  LAN and WAN

# 11 Programming paradigms

**178**.   Main, declarative programming language in logic is:
a) PROLOG

**179**.   Choose PROLOG interpreter's built-in mechanism:
a) Term unification

**180**.   Let's consider the following definition of `member/2` predicate:

```
1
2 member(H,[H|T]).
3 member(H,[_|T]):- member(H,T).
```

What will PROLOG interpreter return after call to  (member(X,[0,1,[2,3],4]):
a) Exactly one solution

**181**.   Let's consider the following definition of `member/2` predicate:

```
1 member(H,[H|T]).
2 member(H,[_|T]):- member(H,T).
```

What will PROLOG interpreter return after call to `member(X,[0,1,2,1,3,1,4])`:
a) 7 solutions including 3 identical solutions

**182**.   Let's consider the following definition of `append/3` predicate performing lists concatenation:

```
1 append([],L,L).
2 append([H|T],L,[H|TL]) :- append(T,L,TL).
```

What will PROLOG interpreter return after call to `append(L1,L2,[1,2,3,4,5]).`:
a) 4 different solutions

**183**.   Let's consider the following definition of `append/3` predicate performing lists concatenation:

```
1 append([],L,L).
2 append([H|T],L,[H|TL]) :- append(T,L,TL).
```

What statement should be executed to retrieve last element of L list (e.g. L = [1,2,3,4]) and bind it to the E E=4) variable:
a) `append(_,E,L).`

**184**.   Let's consider the following PROLOG program:

```
1 p(a).
2 p(b).
3 p(c).
4 p(a).
5 p(c).
6
7 run :-
8        p(X),
9        assert(q(X)),
10       fail.
```

What will be the final result of compilation and execution of the `run`:
a) There will be 5 facts stored into memory, namely `q(a).  q(b).  q(c).  q(a).  q(c).`

**185**.   Let's consider the following PROLOG program:

```
1  ln(0,[]) :- !.
2  ln(N,[N|L]) :- N1 is N-1, ln(N1,L).
```

What will be the final result of compilation and execution of the `ln(7,L)`:
a) The result `L=[1,2,3,4,5,6,7]`

**186**. Let's consider the following PROLOG program:

```
1  s1(X):- not(p(X)),!, q(X).
2  s2(X):- q(X), not(p(X)).
3  p(a).
4  q(b).
```

What will be the final result of compilation and execution:
a) s1(X) returns a; s2(X) returns false

**187**. Let's consider the following PROLOG implementations of the iterrative summation of given list. Which implementation is correct:
a)

```
1  loop([],S,S).
2  loop([H|T],A,S) :-
3         AH is A+H,
4         loop(T,AH,S).
```

**188**. What will be the inferred type of the Haskell expression r x = x:r x
a) r :: [a]

**189**. Which one of below statements is correct if the Haskell type definition is
data Tree a = L a | N (Tree a) a (Tree a)
a) Tree 5 Nil Nil

**190**. Which programming paradigm applies to Haskell languague:
a) declarative

**191**. Choose the properties of Haskell type checking system:
a) strong

**192**. Choose the correct answers
a) The following are functional languagues: Erlang, Haskell, C#, Perl.

**193**.
Which of the below statements apply to higher order functions
a) those are informal terms of hard to implement functions

**194**. What is the main mechanism in functional languagues that enable computation on collection of data
a) recursion

**195**. Choose the correct statement about functional programming
a) In functional programming style IO operations maybe perforemd exclusively within Monads.

# 12   Programming of microcontrollers and microprocessors

**196**.   How many 8-bit registers available to the programmer contains a x86 family processor?
a) 8

**197**.   What addressing mode is used in instruction ADDL (%ebx),%eax?
a) indirect

**198**.   Which instruction is equivalent in operation to SHL $1,%eax instruction?
a) RCL $1,%eax

**199**.   Which of the following instructions applies to operations on data blocks?
a) CMC

**200**.   Which rule can be used for conversion to an integer number in FPU (Floating Point Unit)?
a) round up

**201**.    How many times (in 32-bit mode) a loop based on LOOP instruction will be repeated, if the content of %ecx register is equal to 0 just before the start?
a) 1

**202**.   How many times (in 32-bit mode) the content of %ah register will be stored to memory using REP STOSB instruction, if, before its execution, the content of %ecx register is equal to $x$?
a) $x - 1$

**203**.   What will be the content of the %eax register after a sequence of following instructions?

```
1 MOVL  $0xFFFF0000,%eax
2 NEG %eax
```

a) `0x00000000`

**204**.   What will be the content of the %al register after a sequence of following instructions?

```
1 MOVW  $0xFF00,%ax
2 ADCB  %ah,%al
3 ADCB  %ah,%al
```

a) `0x0F`

**205**.   What kind of diagram shows the electrical connections in the microcontroller based system?
a) schematic diagram

**206**.   What kind of microcontroller memory typically stores user program code?
a) DRAM

**207**.   Which parts of microcontrollers do not exist in microprocessors?
a) RTC

**208**.   Is the machine language identical with the assembly language?
a) yes - only for microprocessors

**209**.   What tool is used to convert code written in assembly language into machine code?
a) assembler

**210**.   Which tool does not allow the creation of code for AVR microcontroller?
a) WinAVR

# 13 Operating systems

**211**.   Which statement is true about associative memory?
a) There is no need to determine the address, ie. data is used as address

**212**.   To avoid time dependent errors, the maximum number of processes that may be inside the critical section is
a) 16

**213**.   The strategy, which allows a process that meets the execution conditions be temporarily suspended, is called:
a) preemptive scheduling

**214**.   The privilages instruction:
a) is used in the systems without the interruption mechanism

**215**.   Inter-process communication:
a) is required for all processes

**216**.   Within the virtual memory organization, the dynamic address translation:
a) requires hardware support for paging system

**217**.   Initial value of the general semaphore that implements the critical section is:
a) true

**218**.   The process of transferring the data, which will be finally routed to a peripheral device, to the secondary storage and transferring them to the device at a more convenient time is called:
a) virtualization

**219**.   Producer-consumer problem can be solved by using:
a) monitors

**220**.   The CPU, after receiving information about the interruption from the I/O devices
a) stops for a specified period of time

**221**.   Which of the following problems does the Dijkstra's Banker's algorithm solve?
a) mutual exclusion

**222**.   If the virtual address in the program is 16 bit and the page size is 0.5 K, what is the maximum number of pages we can address?
a) 128

**223**.   The operating system is:
a) software routines collection

**224**.   In the memory management system, DATUM and LIMIT registers...
a) are used to protect the temporary variables

**225**.   If the operating system wants to execute more than one program at a given time, it has to:
a) have virtual memory

**226**.   Public key encryption within asymmetric encryption
a) creates a shortcut function in the electronic signature

**227**.   Files buffering is realized in order to:
a) increase the capacity of the main memory

# 14    Software engineering

**228**.    From among the following, identify the legal data flows in a data flow diagram
a)  Data store to a data store

**229**.    What is the goal of testing?
a)  Prove that the software is correct

**230**.    What are the main activities in the spiral model?
a)  defining, prototyping, testing, product delivery

**231**.    Which of the following is not a valid view in the Kruchten's model
a)  [true] conceptual

**232**.    What role in UML class diagrams has composition?
a)  it is relation gen-spec between classes

**233**.    The aim of software engineering is to produce software that is
a)  [true] fault-free

**234**.    An example of the risk involved in software development is
a)  [true] technology changes may render the product obsolete

**235**.    The requirements model consists of four parts
a)  Use cases, interface descriptions, class diagram, project scope

**236**.    Identify the correct statement from among them
a)  the level 0 DFD is the same as the context diagram

**237**.    Creating an object model from an existing relational database layout is referred to as
a)  Forward engineering

**238**.    Which of the following statements relating to the UML diagrams states are true?
a)  [true] the action is indivisible computational procedure

**239**.    Prototyping is appropriate for
a)  applications with emphasis on the user interface

**240**.    Which of the following is not an objective for building analysis models?
a)  [true] develop a solution for the problem

**241**.    An initial attempt at defining the pieces/parts of the system and their relationships, organizing these pieces/parts into well-defined layers with explicit dependencies is called
a)  use-case analysis

**242**.    Which of the following is not a concern during the management of a software project?
a)  time

**243**.    A static perspective in RUP includes
a)  [true] activities

**244**.    Which of the following tool is not used during system analysis?
a)  Data Flow Diagram

# 15    Concurrent and distributed programming

**245**.    Mark correct functional object definition in Erlang.
a) F1(X) -> X+1.

**246**.    Mark value of a given Erlang expression:  [1,2,3]  $--$  [3,2,3,5].
a) $[1,-3,-5]$

**247**.    Erlang type system is:
a) static - checked during compilation

**248**.    How to make an Erlang process executing F1 function?
a) Pid  is  spawn_exec(F1).

**249**.    How to send a message to Erlang process with a given PID?
a) Pid  send  Mesg.

**250**.    Which communication model is used in Erlang?
a) shared memory

**251**.    Erlang interprocess communication is based on:
a) rendezvous

**252**.    Value of the given Elang expression is:  lists :map(fun(X) $->$ {X,X+1} end,[1,2,3])
a)  [{1,1},{1,3},{1,4}]

**253**.    What is the purpose of the protected object in Ada anguage?
a) Allow internet requests to acces local data.

**254**.    Which operations may be defined for controlled type in Ada language?
a) Copying constructor and destructor.

**255**.    How to denote parameter direction in Ada language?
a) Parameters are always input only

**256**.    Type system in Ada is?
a) optional

**257**.    How tasks communicate in Ada?
a) There is no communication between tasks.

**258**.    Select algorithms suitable for coordinator election in distributed systems?
a) Vector clock algorithm.

**259**.    Select true sentences.
a) Amdahl's law is a formula which gives the theoretical speedup of a task after changing size of a problem.

# 16 Database Systems

**260**. Select all true statements concerning the keys in the relational data model.
a) A foreign key cannot be a primary key of a relation.

**261**. Given the relation $R$, its schema $H = \{A, B, C, D, E, F, G\}$ and a set of functional dependencies $F = \{\{C\} \rightarrow \{A\}, \{C\} \rightarrow \{B, F\}, \{C\} \rightarrow \{G\}, \{E\} \rightarrow \{C\}, \{G\} \rightarrow \{A, B\}\}$, select keys of the relation $R$.
a) $\{A, B, C, D, E, F, G\}$

**262**. For which of the following operations of relational algebra, scheme(s) of argument(s) and of the resulting relation are the same?
a) projection

**263**. Assume that in a query based on two relations we replace internal join operator with an outer join operator. Select these operators, which use guarantees a result not lesser (in the sense of inclusion) than using the internal join operator.
a) full outer join

**264**. Select cases in which clauses of *select* statements are provided in the correct order.
a) from, having, group by, where

**265**. Select the elements allowed in the conceptual data model which are not compatible with the relational data model.
a) recursive relationships one-to-one

**266**. Let the relation $R$, its schema $H = \{A, B, C, D, E, F\}$ and a set of functional dependencies $F = \{\{A\} \rightarrow \{B\}, \{C\} \rightarrow \{D, E\}, \{A, C\} \rightarrow \{F\}\}$ be given. Which of the following decompositions of $R$ relation into relations with schemas $H_1$, $H_2$ i $H_3$ are lossless?
a) $H_1 = \{A, B\}$, $H_2 = \{C, D, E\}$, $H_3 = \{A, C, F\}$

**267**. Select all true statements about the Boyce-Codd normal form.
a) Any 2-argument relation is in BCNF.

**268**. Let the relation $R$, its schema $H = \{A, B, C, D, E\}$ and a set of functional dependencies $F = \{\{B, C\} \rightarrow \{D, E\}, \{C, D\} \rightarrow \{B, E\}, \{D\} \rightarrow \{C\}, \{E\} \rightarrow \{B\}\}$ be given. Which is the highest normal form of the relation $R$ assuming it is in 1NF?
a) BCNF

**269**. Select all true statements regarding the third normal form.
a) Any relation can be transformed into 3NF with lossless decomposition.

**270**. Select all true statements regarding foreign keys in the relational data model.
a) A foreign key and the key it refers to have to consist of the same number of attributes.

**271**. Select all true statements regarding the usage of aggregate functions in PostgresSQL.
a) Inside of a *group by* clause, the arguments not present in the *select* clause can be used.

**272**. Select all true statements regarding transactions.
a) Data modified by a transaction which is not yet completed are never available for other concurrently executed transactions.

**273**. Select the constraints which can be defined on the column level (in the *create table* statement).
a) complex foreign keys

**274**. Select all true statements regarding the *null* value.
a) In the relational data model null value is treated as the third logical value, in addition to the *false* and *true* values.

# 17 Formal languages and automata

**275**. A grammar is ambiguous if
a) its language contains ambiguous sentences

**276**. Which of the strings below belong to the language generated by the following grammar $G = \langle\{Q, R, X\}, \{\triangle, \triangledown\}, \{X \to \triangledown \triangle R, X \to \triangle \triangledown Q, R \to \triangle \triangledown X, R \to \triangle \triangledown, Q \to \triangledown \triangle X, Q \to \triangledown \triangle\}, X\rangle$:
a) $\triangledown \triangle \triangle \triangle \triangle \triangledown \triangledown \triangledown \triangledown \triangle \triangle \triangle$

**277**. Which of the following sentences are true for Kleene closure (Kleene star):
a) it is a set of strings created by combining strings of any length without strings of length 0

**278**. Notation $L^* = \bigcup_{i=0}^{\infty} L^i$ for languages means:
a) operation of composition in infinity

**279**. The following statements are true for classifying Chomsky's grammars:
a) contains grammars and shortening and non-shortening productions

**280**. For formal languages and grammars, with reference to Chomsky normal form and Greibach normal form, it is possible to formulate the following statements (upper-case letters of the Latin alphabet are nonterminal symbols, and lower-case letters are terminal symbols):
a) a grammar in Chomsky form contai+ns productions $A \to BC, A \to a$, and a grammar in Greibach form contains productions $A \to aX$ (where $X$ is a series of nonterminal symbols, which may be empty), and each context-free grammar in Chomsky normal form can be transformed to Greibach normal form

**281**. As far as the pumping lemma for regular languages is concerned, the following statements are true:
a) the lemma shows that given languages are not regular

**282**. If $Lin$ denotes linear grammars, $BK$ - context-free grammars, $Reg$ - regular grammars, $PL$ - right linear grammars, and $LL$ - left linear grammars, which of the following relations are true:
a) $PL \subseteq Lin$

**283**. Which general statements regarding languages, grammars and automata are true:
a) if $L$ is a context-free language, there exists a pushdown automaton which accepts this language and they are equivalent
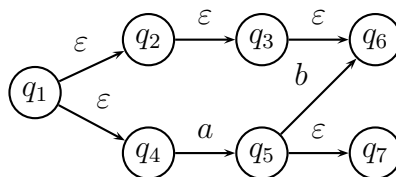
**284**. For a given determined language $L$ and alphabet $V$, *quotient language* $L/x$ is a language in a form:

$$L/x = \{y \in V^* : xy \in L\}$$

for $x \in V^*$. Which statements are true:
a) if language $L$ is regular, there exist exactly as many regular languages as states obtainable in deterministic finite automaton which accepts $L$

**285**. $\varepsilon$-closure $E$ for the initial state $q_1$ for the automaton presented below



are sets
a) $E(q_1) = \emptyset$ – is not possible to find due to $\varepsilon$-transitions

**286**. We have a nondeterministic automaton $A = \{S = \{A, B, C\}, V = \{0, 1\}, \{\delta(A, 1) = B, \delta(A, 1) = C, \delta(B, 0) = A, \delta(C, 0) = B\} s_0 = A, Z = \{C\}\}$ After determinization, the automaton (understood as Rabin-Scott algorithm) will have:

a) eight states

**287.** If $r$ and $s$ are regular expressions for languages respectively $R$ and $S$, then $(r + s)$, $rs$ and $r^*$ are regular expressions which respectively represent sets:
a) $R \times S$, $RS$ i $R^*$

**288.** A regular expression $(0 + 1)^*00(0 + 1)^*$ describes:
a) strings beginning with zero and ending with one with at least one case of doubling zeros

**289.** We have languages $L_1 = \{a^{2^n} : n > 0\}$ and $L_2 = \{a^{2n} : n > 0\}$. Which languages are regular?
a) $L_1$ – yes, $L_2$ – no

# 18 Compilers and theory of compilation

**290**.   A typical formal language scanner should:
a) count left and right brackets and initially check their matching

**291**.   A typical formal language parser should:
a) detect syntax errors

**292**.   Canonical parsing is a parsing that:
a) reduces rightmost symbols of a sentential form at first

**293**.   Using a generative method of grammar parsing:
a) starting from the input string, we try to reach the grammar starting symbol

**294**.   Using a reductive method of grammar parsing:
a) starting from the input string, we try to reach the grammar starting symbol

**295**.   Following sentences are true for $LL(k)$ class analyzers:
a) parameter $k$ stands for the number of symbols that are pushed/popped form the stack at once

**296**.   Following sentences are true for $LL(k)$ class analyzers:
a) they use a stack

**297**.   Removing $\varepsilon$-production form a $G_{LL(k)}$ class grammar results in:
a) increasing the value of $k$ parameter in that grammar/parser

**298**.   Following sentences are true for $LR(k)$ class analyzers:
a) stack holds the prefixes and suffixes of the sentential forms that might be used

**299**.   Following sentences are true for $LR(k)$ class analyzers and the $action$ function:
a) $action$ function takes value form the set $\{shift, reduce, accept, error\}$

**300**.   For $LR(0)$ class parsing tables and an example production rule $A \rightarrow XYZ$ we have:
a) three possible parsing situations plus one for the symbol on the left-hand side of the rule

**301**.   Building parsing tables for $LR$ analyzers is problematic, what indirectly led to inventing many variations of this parser. Which of the following sentences are true:
a) first letter in name $LALR$ stands for *Left Action*

**302**.   For a certain grammar and $\gamma \in V^*$ we say that a $LR(0)$ parsing situation denoted as $[N \rightarrow \beta_1.\beta_2]$ is correct when assuming $\alpha\beta_1 = \gamma$, it is true that:
a) $S \overset{rm*}{\Rightarrow} \alpha N \omega \overset{rm*}{\Rightarrow} \alpha\beta_1\beta_2\omega$

**303**.   In terms of set of grammars, the following relations between $LR$ parsers are true:
a) $SLR(1) \subset LALR(1) \subset LR(0) = LR(1)$

**304**.   Comparing $LL$ and $LL$ grammars:
a) $LL$ and $LR$ are equivalent grammar classes

# 19 Introduction to artificial intelligence

**305**. Which of the search algorithms guarantee they find the shortest path in the graph (assume that every edge has cost equal 1):
a) Dijkstra's Algorithm

**306**. Tree-Search Breadth-First Algorithm generated 400 nodes at depth equal 3. The estimated *branching factor* of the tree equals:
a) Around 7

**307**. According to the literature, what are the requirements, the heuristic function $h(n)$ has to meet in order to guarantee optimality of the $A^*$ algorithm:
a) $h(n)$ function should be monotonic

**308**. Genetic Algorithms (GA) are used in optimization problems involving constraints and complex quality criteria. Which properties belong to these algorithms:
a) GA are heuristic algorithms

**309**. Let us consider the classical cryptoarithmetic problem: SEND+MORE=MONEY. What is the estimated number of solutions which have to be explored in order to find the solution? Notice that M must be equal 1 and assume that you know nothing more about the other variables. Choose the best optimistic estimation.
a) Less than 100 000 value assignments.

**310**. Let us consider Tower of Hanoi with three rods and $N$ disks. What is the number of possible states and number of steps in the optimal solution:
a) $3^N$ states and $2^N - 1$ steps

**311**. Let us consider constraint programming task with three decision variables X, Y, Z. All variables are constrained to have different values (alldifferent([X,Y,Z])). Domains of the variables are: $D(X) = \{1, 2, 3\}$, $D(Y) = \{2, 3, 4\}$, $D(Z) = \{3, 4, 5\}$ What is the number of admissible solutions?
a) 13

**312**. Which sentence is not logically entailed by the following set of sentences:

$$\{\neg A \vee P, \neg P \vee B \vee D, \neg D \vee N, \neg D \vee M, \neg D \vee H, \neg H \vee \neg S \vee R, \neg H \vee R \vee I, A, \neg B, \neg R\}$$

a) $P \wedge D \wedge S$