

Faculty of Informatics, Masaryk University



Entrance Examination

Computer Science

June 2012

1 Algorithms and data structures

1. Hash algorithm provides mapping:
 - (a) keys to associated values ✓
 - (b) associated values to keys
 - (c) associated values to associated values
 - (d) keys to keys
 - (e) mapping is not provided, algorithm is typically used for text compression
2. Assume existence of double linked list of items (data structure) with stored pointer to first item. Length (number of items) of list is n . Which statement is **not** correct?
 - (a) Time complexity of removal of single already found item from list is $O(1)$
 - (b) Time complexity of retrieval of first item is $O(1)$
 - (c) Time complexity of search for specific item is $O(1)$ ✓
 - (d) Time complexity of insertion of new item after already found item is $O(1)$
 - (e) Memory overhead of list is typically higher than for plain array of values
3. Which statement is correct for data structure known as AVL tree (self/balancing binary search tree)?
 - (a) Contains one cycle at maximum, one root, nodes and leafs
 - (b) Depth of AVL tree is always logarithmic with respect to number of nodes ✓
 - (c) If there is $(n - 1)$ nodes, then there is exactly n edges
 - (d) Search operation in AVL tree with n nodes has time complexity $O(\log(\log(n)))$
 - (e) Depth of AVL tree is quadratic with respect to number of nodes at worst
4. Which statement is correct for data structure known as stack?
 - (a) Stack contains at least two items (bottom and top of the stack)
 - (b) Item inserted as last will be read out as last
 - (c) Item inserted as last will be read out as first ✓
 - (d) Item with smallest value is always kept at the bottom of the stack
 - (e) Item with smallest value is always kept at the top of the stack
5. Which statement is correct for data structure known as priority queue?
 - (a) Item inserted as last will be read out as first
 - (b) Item inserted as last will be read out as last
 - (c) Item with highest assigned priority will be read out as first ✓
 - (d) Item with lowest assigned priority will be read out as first
 - (e) Items in the structure are ordered based on order of insertion

2 Programming

```
6. a = 0;
   b = 5;
   c = 0;
   while (a < 5) {
       b = 5;
       while (b > a) {
           c = c + 1;
           b = b - 1;
       }
       a = a + 1;
   }
```

What values will the variables `a`, `b`, `c` have after execution of the given code?

- (a) `a = 0, b = 5, c = 0`
 - (b) `a = 5, b = 4, c = 15` ✓
 - (c) `a = 5, b = 5, c = 5`
 - (d) `a = 4, b = 5, c = 20`
 - (e) `a = 4, b = 4, c = 5`
7. Decide which statement **is not valid** in common OOP languages (C++, Java, C#):
- (a) Code block where exceptions are to be captured is enclosed in `try {}` statement
 - (b) Exception is propagated to calling function if not caught in the current function
 - (c) When exception is caught and served, program execution will continue on the next instruction after the instruction that caused the exception ✓
 - (d) Standard library contains several predefined types of exceptions and new exceptions types can be defined
 - (e) Uncaught exception will abort the program execution
8. Decide which statement is generally valid in common OOP languages (C++, Java, C#):
- (a) Class is instance of object
 - (b) There can be only one instance for every class in given time
 - (c) Object is instance of class ✓
 - (d) Class declares headers of methods, objects defines implementation of methods
 - (e) Term „class” is not used in object oriented programming terminology, correct term is „object”
9. Decide which statement is generally valid in common OOP languages (C++, Java, C#):
- (a) Encapsulation allows to hide internal implementation of methods, but doesn't allow to hide attributes of the class
 - (b) Access rights can be used to control access to attributes of the class, but not to the methods of the class
 - (c) Encapsulation helps to simplify method header by hiding all method's arguments
 - (d) Encapsulation helps to increase robustness of implementation by hiding internal details of object's state and restricts its modification ✓
 - (e) Encapsulation is automatically provided by execution environment on the level of memory protection without necessity to specify access rights

3 Databases

10. What is the result of the following SQL query?

```
SELECT max(product.price)
FROM product, company
WHERE company.id = product.id AND company.name = "Company a.s."
```

- (a) Prices of the most expensive products of individual companies
 - (b) Price of the most expensive product produced by the „Company a.s.” ✓
 - (c) Prices of the „Company a.s.” products sorted in ascending order
 - (d) Name of the most expensive product produced of the „Company a.s.”
 - (e) Company producing the most expensive product
11. Select a **false** statement about the candidate key:
- (a) Entity set can have more candidate keys
 - (b) Candidate key is a minimal superkey
 - (c) Candidate key uniquely identifies entities in an entity set
 - (d) Candidate key can be composed of more than one attribute
 - (e) Candidate key is selected primary key ✓
12. Normal forms of relational databases **do not** include:
- (a) Chomsky NF ✓
 - (b) Boyce-Codd NF
 - (c) Fourth NF
 - (d) Third NF
 - (e) Second NF
13. B-Tree is:
- (a) abbreviation for the Binary Search Tree structure
 - (b) unbalanced N-ary tree
 - (c) unbalanced binary tree
 - (d) balanced n-ary tree ✓
 - (e) balanced binary tree
14. Hash function in the context of databases:
- (a) must be invertible
 - (b) is transitive
 - (c) is symmetric
 - (d) translates keys into restricted address space ✓
 - (e) is used for the implementation of binary search trees

4 Computer networks

15. Authentication is a security function to ensure the
- (a) compliance with the legislation
 - (b) access control to object
 - (c) trusted proving of identity ✓
 - (d) integrity
 - (e) compliance with the security policy
16. Term „local network” represents an environment defined by
- (a) geographical coverage and ownership ✓
 - (b) local language characteristics
 - (c) legislative valid in a local environment
 - (d) number of connected nodes (computers)
 - (e) list of localized application systems
17. TCP (Transport Control Protocol) does **not** provide for
- (a) addressing points of communication between processes
 - (b) the lossless transmission
 - (c) routing ✓
 - (d) flow control
 - (e) connection setting
18. The network layer of the Internet uses for data transfer
- (a) connectionless protocol without acknowledgement ✓
 - (b) connectionless protocol with acknowledgement
 - (c) connection-oriented protocol without acknowledgement
 - (d) connection-oriented protocol with acknowledgement
 - (e) virtual circuits
19. Forward error correction codes allows the receiver
- (a) to detect all errors that may occur anywhere in the message, and to correct these errors without retransmission
 - (b) to correct all errors without retransmission
 - (c) to detect a limited number of errors that may occur anywhere in the message, and often to correct these errors without retransmission ✓
 - (d) to detect a limited number of errors that may occur anywhere in the message
 - (e) to detect a limited number of errors that may occur in very short messages

5 Principles of computer systems

20. What octal number is equivalent of the binary number 001101111010?
- (a) 1572 ✓
 - (b) 7172
 - (c) 8572
 - (d) 0562
 - (e) 1672
21. One of the following conditions is **not** a prerequisite for the emergence of deadlocks
- (a) Mutual exclusion
 - (b) Hold and wait
 - (c) No preemption
 - (d) Circular wait
 - (e) Symmetric multiprocessing ✓
22. Planning processes run in computing system controlled by operating system is task of
- (a) operating system kernel ✓
 - (b) processor microprograms
 - (c) operating system layer provided service interface to process owners
 - (d) program segments inserting to programs during translation
 - (e) process owners
23. The capacity of the logical address space is given by
- (a) capacity of the connected discs
 - (b) the capacity of the installed physical address space
 - (c) compilers
 - (d) the format of addresses in machine language statements ✓
 - (e) the name space of high level source language
24. Process running under a common operating system that supports demand-paging
- (a) calls for the introduction of the page by calling the operating system services
 - (b) calls for the introduction of the page by sending a message to the kernel of the operating system
 - (c) is controlled by a program that is not specially prepared for demand-paging ✓
 - (d) is controlled by a program that is specially prepared for demand-paging
 - (e) cannot send messages to another process