PEOPLES´ FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA

RUDN UNIVERSITY

Tests for RUDN University Open Olympiad for Foreign Citizens

COMPUTER SCIENCE(B)

Variant 1

Choose one or more correct answers in the test tasks.

Transfer the answer numbers to the answer sheet:

question	answers	question	answers
1		16	
2		17	
3		18	
4		19	
5		20	
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Q1: It is known that logical function A is given by the expression: $(\bar{x} \wedge y \wedge z) \vee (\bar{x} \wedge \bar{y} \wedge z) \vee (\bar{x} \wedge \bar{y} \wedge \bar{z})$. The table below shows a fragment of the truth table of function A containing all sets of arguments for which function A is true.

Variable 1	Variable 2	Variable 3	Function
???	???	???	A
0	0	0	1
1	0	0	1
1	0	1	1

Determine which column of the truth table of function A corresponds to each of variables *x, y, z*.
In the answer, write letters ***x, y, z*** in the order in which the corresponding columns appear.

a. xyz
b. xzy
c. yzx
d. zxy

Q2. Teachers expressed their wishes about the first five lessons when making up the schedule for Monday. The drawing teacher wants to have the second or third lesson, the mathematics teacher wants the first or second lesson, the computer science teacher wants the third or fourth lesson, the geography teacher wants the third or fourth, the Russian language teacher only agrees to the first or fifth lessons. Which schedule option will suit all teachers at the school? (Notations: D – drawing, M – mathematics, C – computer science, G – geography, R – Russian language.)

a. D M C G R
b. M R D C G
c. M D C G R
d. R D M G C

Q3. The stereo audio file is transmitted at the speed of 32000 bps. The file was recorded with average sound quality: encoding depth – 16 bits; sampling rate – 48000 samples per second; recording time ─ 90 seconds. How long will it take for the file to be transferred? Indicate time in seconds.

a. 4320
b. 8300
c. 4200
d. 1720

Q4. Vasya has access to the Internet via a high-speed one-way radio channel, which provides him with a speed of 2^{17} bits per second. Petya has no high-speed Internet access, but he can receive information from Vasya via a low-speed telephone channel with an average speed of 2^{16} bits per second. Petya agreed with Vasya that the latter would download 8 MB of data for him via a high-speed channel and relay it to Petya via a low-speed channel. Vasya's computer can begin relaying data no earlier than it receives the first 1024 KB of these data. What is the minimum possible time (in seconds) from the moment Vasya starts downloading the data until Petya has received them completely?

e. 2080
f. 1088
g. 1024
h. 2084

Q5. The article typed on a computer contains 64 pages, each page has 40 lines, each line has 64 characters. Determine the size of the article in KOI-8 encoding, where each character is encoded with 8 bits.

i. 320 KB
j. 1 bit
k. 1024 bytes
l. 160KB

Q6. Match the decimal and binary numbers:

Decimal System	Binary System
1) 2520	a) 101000000100
2) 2420	b) 100101110010

3) 2568	c) 100101110100
4) 2564	d) 101000001000
	e) 11111100100

a. 1) e; 2) b; 3) a; 4) d
b. 1) a; 2) c; 3) b; 4) d
c. 1) e; 2) c; 3) d; 4) a
d. 1) b; 2) c; 3) a; 4) e

Q7. You are on a treasure hunt and have found a riddle leading to the final treasure:

"The treasure lies where the sun shines brightly, but only after it has rained and the wind blows from the south. However, there may be no wind if the sky is clear."
Which of these scenarios indicates the correct location of the treasure?

m. The sun is shining, it rained yesterday, and the wind is blowing from the west.
n. The sun is shining, it rained lightly this morning and the wind is south.
o. The sky is clear, there has been no rain for a long time, and there is no wind.
p. The sun is shining, it rained yesterday, there is wind.

Q8. Fill in the missing words into the text. In your answer, indicate the sequence of numbers that correspond to the chosen word.

The _____, which hides all the realities of the hardware from the programmer and provides the opportunity to simply, conveniently view the specified _____, read or write, is, of course, an operating system. Just as the OS protects programmers from the disk drive hardware and provides them with simple file _____, the operating system takes care of all the unpleasant tasks associated with interrupt handling, timer management and _____ memory, as well as others.

1.	Program
2.	File
3.	Interface
4.	System
5.	Virtual
6.	Random access
7.	Document

a. 1236
b. 4726
c. 1735
d. 4276

Q9. Performer Draftsman has a pen which can be raised, lowered, and moved. When you move a lowered pen, a trace in the form of a straight line remains behind it. The Performer has the following commands:

Move by vector (a, b) - the Performer moves to a point which can be reached from this one by moving a units horizontally and b units vertically.

Entry: Repeat 5 [Command 1 Command 2] means that the sequence of commands in square brackets is repeated 5 times.

The Draftsman is located at the point with coordinates (5, 2). The Draftsman was given the following algorithm to execute:

Move by vector (2, -4)
Move by vector (6, 7)
Repeat 7[Move by vector (1, -4)]
Move by vector (1, 3)

At what distance from the origin of coordinates will the Draftsman be as a result of executing this algorithm? Indicate the square of this number in your answer?

a. 132
b. 441
c. 212
d. 841

Q10. The algorithm is written below. Given the number x as input, this algorithm prints two numbers a and b. Indicate the largest of such x numbers upon input of which the algorithm prints first 2 and then 35.

Basic	Pascal

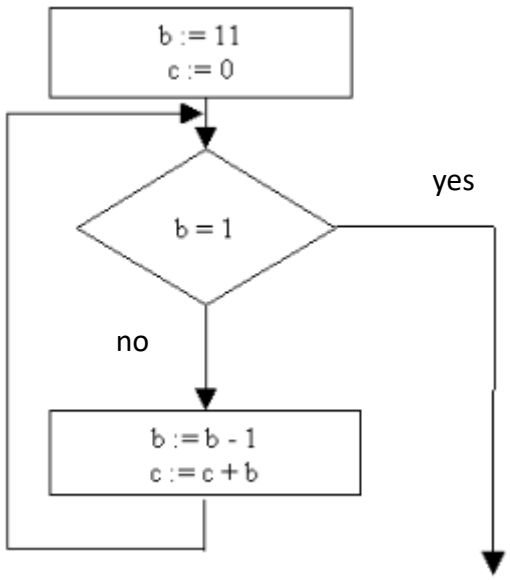
DIM X, A, B AS INTEGER
INPUT X
A=0 : B=1
WHILE X > 0
A = A+1
B = B * (X MOD 10)
X = X \ 10
WEND
PRINT A
PRINT B
	var x, a, b: integer;
	begin
	readln (x);
	a := 0 ; b := 1;
	while x>0 do
	begin
	a := a + 1;
	b : = b * (x mod 10);
	x := x div 10;
	end;
	writeln(a); write(b);
	end.

C++	**Python**

#include <iostream>
using namespace std;
int main()
{
int x, a, b;
cin >> x;
a=0; b=1;
while (x>0) {
a = a+1;
b = b * (x%10);
x = x/10;
}
cout << a << endl << b endl;
}
	x = int(input())
	a = 0
	b = 1
	while x > 0:
	a += 1
	b *= x % 10
	x = x // 10
	print(a)
	print(b)

a. 10
b. 35
c. 57
d. 75

Q11. In the program, := denotes the assignment operator, the +, -, * and / signs respectively mean the operations of addition, subtraction, multiplication and division. The rules for performing operations and the order of actions correspond to the rules of arithmetic. Determine the value of variable c after executing the algorithm fragment:



a. 100
b. 55
c. 0
d. 49

Q12. Fill in the missing words into the text. Indicate the sequence of numbers which correspond to the chosen word in your answer.

A _____ is a computer which can be easily transported and can operate autonomously, which is possible thanks to the battery, as in other types of _____ computers. In addition, a distinctive feature from desktop computers is the presence of combined components, a display and a keyboard in one case. And the ability to _____ makes them even more compact.

1.	Fold up
2.	Laptop
3.	Portable
4.	System
5.	Mobile
6.	Tablet
7.	Scale up

a. 231

b. 651
c. 657
d. 247

Q13. Oleg needs to use spreadsheets to build a table of two-digit numbers from 30 to 69. To do this, first, he wrote down the numbers from 0 to 9 in the range B1:K1 and the numbers from 3 to 6 in the range A2:A5. Then he wrote down the formula for a two-digit number (A2—the number of tens; B1—the number of units) in cell B2, and after that he copied it to all the cells in the range B2:K5. As a result, he got a table of two-digit numbers. The figure below shows a fragment of this table:

	A	B	C	D	E
1		0	1	2	3
2	3	30	31	32	33
3	4	40	41	42	43
4	5	50	51	52	53
5	6	60	61	62	63

Which formula was written down in cell B2?

a. =A2*10+B1
b. =$A2*10+B$1
c. =A$2*10+$B1
d. =$A2*10+$B1

Q14. Filename masks are used for group operations with files. The mask is a sequence of letters, numbers and other characters allowed in file names which may also contain the following characters:

Symbol "?" (question mark) means exactly one arbitrary character.
Symbol “*” (asterisk) means any sequence of characters of arbitrary length, and specifically “*” can also specify an empty sequence.
There are 7 files in the directory:
bark4.cpp
bbo.pas
boat4.p
bb4.pt
abc4.jpg
b4r.pas
boot.p

Determine which of the listed masks from these 7 files will the specified group of files be selected by:
bark4.cpp
bb4.pt
abc4.jpg
b4r.pas

q. *4.*p?*
r. *b*4*. p?*
s. *4*.*p*?*

t. b?4*. *p*

Q15. The table shows several records from the Points database:

Surname	Sex	Mathematics	History	Physics	Chemistry	Biology
Chernenko	m	80	72	68	66	70
Glebov	m	75	88	69	61	69
Smith	f	85	77	73	79	74
Chekhov	m	77	85	81	81	80
Kovalenko	f	88	75	79	85	75
Lebedeva	f	72	80	66	70	70

Indicate how many records satisfy the condition:

"Sex = 'f' And Physics < Biology"?

a. 2
b. 3
c. 6
d. 1

Q16. A series of two digits may be called suitable if any of two conditions are met:

1) The sum of the digits is even, and the second digit is greater than the first.
2) The sum of the digits is odd, and the second digit is less than the first.

A multi-digit number can be called suitable if any two adjacent digits in its notation form a suitable series.

Examples of suitable numbers: 26, 63, 30, 2630, 26308.

An example of an unsuitable number: 2638. This number cannot be considered suitable, since the adjacent numbers 3 and 8 in its notation form an unsuitable series.

How many suitable 12-digit novenary numbers are there?

a. 33554432
b. 4194304
c. 37748736
d. 150994944

Q17. There are two segments on the number line: P = [2, 10] and Q = [6, 14]. Choose such segment A that the formula

$$((x \in A) \rightarrow (x \in P)) \vee (x \in Q)$$

is identically true, i.e., it takes value 1 for any value of variable x.

u. [0, 3]
v. [3, 11]
w. [11, 15]
x. [15, 17]

Q18. Alice encrypts English words by writing down each letter's number in the alphabet (without spaces). Letter numbers are given in the table:

A 1	K 11	U 21
B 2	L 12	V 22
C 3	M 13	W 23
D 4	N 14	X 24
E 5	O 15	Y 25
F 6	P 16	Z 26
G 7	Q 17	
H 8	R 18	
I 9	S 19	
J 10	T 20	

Some encryptions can be decrypted in more than one way. For example, 16118 could mean AFAR, or PAR, or AFAAH. Four encryptions are given:

1) 17205
2) 20127
3) 20217
4) 71205

Determine which of them is decrypted in only one way.

a. 1
b. 2
c. 3
d. 4

Q19. Match the main stages of computer modelling and actions:

1) Problem statement and its analysis	a) Select or develop a method for obtaining initial results.
	b) Assess which parameters are influential for the given task and which can be neglected.
2) Development of a method and algorithm for implementing a computer model	c) Develop a research plan.
	d) Check the correctness of the algorithm.
3) Computer model development	e) Clarify what initial results are and in what form they should be obtained.
	f) Select the means of software implementation of the algorithm on a computer.

a. 1) a; 2) b, f; 3) c.
b. 1) c; 2) b, f; 3) a.
c. 1) e; 2) a, d; 3) f.
d. 1) f; 2) b, c; 3) e.

Q20. Fill in the missing words in the text. Indicate the sequence of numbers which correspond to the chosen word in your answer.

To build a _____ communication line, each node is equipped with an antenna, which is both a transmitter and receiver of _____ waves. Antennas can be of

two types - _____, when electromagnetic waves propagate from it in a certain direction within one sector, and _____, when the waves propagate in all directions and fill the entire space around within a radius determined by the attenuation of the signal power.

1.	Wired
2.	Electromagnetic
3.	Electrical
4.	Wireless
5.	Cordless
6.	Non-directional
7.	Magnetic
8.	Directional

a. 1368
b. 4286
c. 1786
d. 5368