Exam revision

This is a closed book test! No additional equipment is allowed!
The used language is English!
Write clear and readable sentences! All not readable parts won't be rated!
Each correct part will be rated as 1 point in general!
(Advice for final test: task types could be similar with changed values!)

1) How many bytes are needed to represent the decimal number 1024? [2P]

2) Which decimal number is given by the binary representation 11010011 (show calculation)? [2P]

3) Simplify the following truth table (define your used signs/ pictograms for AND, OR, NOT and use disjunctive normal form; advice for final test: task type could be similar with changed truth table values)

A	B	C	D	OUT
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

a) Use a Karnaugh-Veitch-diagram [3P]
b) Give the disjunctive normal form (DNF) for above truth table. [3P]
c) Use the mathematical method given by the axioms of Boolean algebra [3P]
d) Draw the logic gate map for simplified table (use 

for AND,

for OR, for NOT) [2P]

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4) Which architecture is similar to those from Charles Babage and is realized in any modern computer? Give the units and explain them (each in one sentence)? [9P]

5) Remember tty-settings: Flags for the operations can be set using bit-by-bit binary operations. How can you switch on the flag for ECHO (0000 1000) in a given one byte flag? [2P]

6) Give five tasks an operating system kernel must do? [5P]

7) What is non-re-entrant?[1P]

8) What is the difference between cooperative and pre-emptive scheduling?[2P]

9) What is starvation in combination with scheduling at the operating system kernel?[1P]

10) What is an interrupt service routine? [1P]

11) What is the idea behind middleware? Why is middleware beneficial when using different operating systems? [3P]

12) Given the ETF-grammar.
Non-terminal symbols: E, T, F
Terminal symbols: +, *, (,), a, b, c, ..., z
Startsymbol: E
Productionrules: $E \rightarrow T \mid E+T$
$T \rightarrow F \mid T*F$
$F \rightarrow (E) \mid a \mid b \mid c \mid d \mid \ldots \mid z$
Draw the production tree to create the following expression (a+b)*(b+c).
(advice for final test: task type could be similar with changed expression) [5P]

13) Remember the turing machine for adding 1 to a given binary number and write the complete path through the automat when #111# (# = blank symbol) is the starting input on the tape. (advice for final test: task type could be similar with changed input tape) [8P]

$M = (\{z_0, z_1, z_2, z_e\}, \{0,1\}, \{0,1,\#\}, \delta, z_0, \#, \{z_e\})$

$\delta(z_0,0) = (z_0,0,R)$
$\delta(z_0,1) = (z_0,1,R)$
$\delta(z_0,\#) = (z_1,\#,L)$

$\delta(z_1,0) = (z_2,1,L)$
$\delta(z_1,1) = (z_1,0,L)$
$\delta(z_1,\#) = (z_e,1,N)$

$\delta(z_2,0) = (z_2,0,L)$
$\delta(z_2,1) = (z_2,1,L)$
$\delta(z_2,\#) = (z_e,\#,R)$

14) Draw a sate diagram for the following turing machine, which converts unary number representation (like ||||| for 5_{dec}) into a binary one (like 101 for 5_{dec}). (advice for final test: task type could be similar with changed turing machine, compare state diagram of exercise solution of lecture 2) [6P]

M = ({s0,s1,s2,s3}, {|,0,1,X}, {#,|,0,1,X}, T, s0, #, s3)
states, input alphabet, working alphabet, transitions, start state, blank, final state

```
T(s0,|)    =>   (s1,X,L)
T(s0,#)    =>   (s2,#,L)
T(s0,X)    =>   (s0,X,R)
T(s0,0)    =>   (s0,0,R)
T(s0,1)    =>   (s0,1,R)
T(s1,#)    =>   (s0,1,R)
T(s1,0)    =>   (s0,1,R)
T(s1,1)    =>   (s1,0,L)
T(s1,X)    =>   (s1,X,L)
T(s2,X)    =>   (s2,#,L)
T(s2,1)    =>   (s3,1,N)
T(s2,0)    =>   (s3,0,N)
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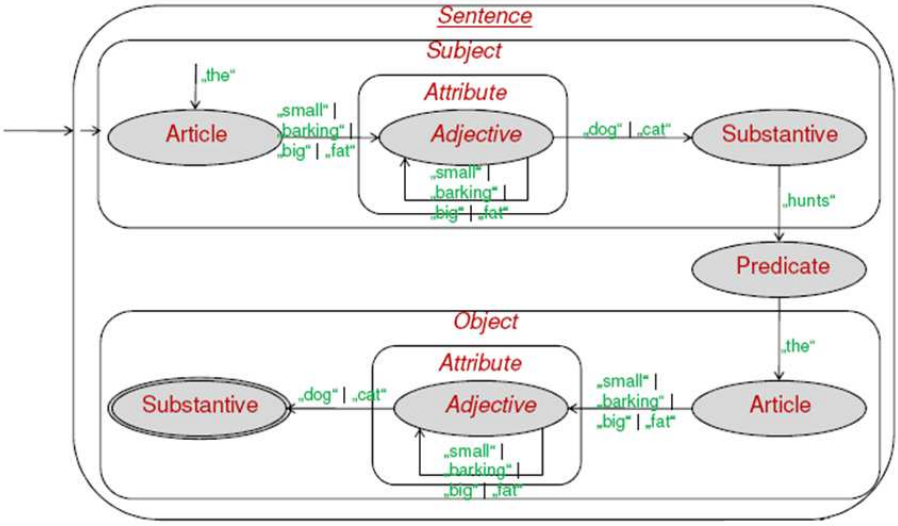
15) What are the four operations of John-von-Neumann-CPU-workflow and what do they do? [8P]

16) What is an Assembler? Give 3 advantages and 3 disadvantages of Assembler [7P]

17) Check the following sentences with the grammar given by graph if they can be produced [4P]



“the dog hunts the big fat cat”
“the small dog hunts the small cat”
“the small barking dog hunts the big fat cat”
“the small small small small dog hunts the barking fat dog”

18) Change the above graph so that it also accepts the sentences “the small dog hunts the fat cat” and “the small cat hunts”. [2P]

19) Which phases are parts of a compilation workflow (draw the graph)?[9P]

20) What is the difference between compiler and interpreter (give the phases in a short scheme)? What about runtime efficiency of compiler and interpreter code? [7P]

21) Give the Matlab characteristics related to
   a) Translation to machine code[1P]
   b) Programming paradigm[1P]
   c) Structure [2P]
   d) Memory elements [2P]
   e) Types [2P]
   f) Operators[2P]
   g) Application workflow [3P]
   h) Flexibility/Best for[2P]

22) The presentations about different computer languages showed us the different for-loop styles in the different languages. Convert the following C for-loop into a Matlab equivalent one (keep in mind the different indexing!).[4P]

```
int i,j;
int A[10][10];
for (i=0; i<10; i++)
{
    for (j=0; j<10; j++)
    {
        A[i][j] = i*j;
    }
}
```

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23) Explain (each with one sentence): alphabet, syntax, grammar, semantic. [4P]

24) Draw a short graphic which shows the sets of Chomsky Hierarchy and give as well the type and name of language types. [5P]

25) Give five programming paradigms and explain them? [5P]

26) Give four quality aims which should be realized with high quality software? [4P]

27) Give the phases of the general top down model, explain shortly why it is also called a waterfall model and give the disadvantages! [7P]

28) Give the phases of the formalized, iterative software process and explain each with one sentence! [12P]

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29) The simplification is also used when a conversion between technical representations of numbers must be done. Now we want to represent the binary numbers from 0_{dez} to 9_{dez} with a 7-segment-display. But we just have a look for one segment (see graphic). Give a simplified form for the conversion into that segment (advice for final test: task type could be similar with changed truth table values).

A	B	C	D	DEZ	7-segment-display
0	0	0	0	0	
0	0	0	1	1	
0	0	1	0	2	
0	0	1	1	3	
0	1	0	0	4	

A	B	C	D	DEZ	7-segment-display
0	1	0	1	5	
0	1	1	0	6	
0	1	1	1	7	
1	0	0	0	8	
1	0	0	1	9	
...					

a) Create the complete truth table for the segment [2P]
b) Give the disjunctive normal form (DNF) for above truth table. [3P]
c) Use a Karnaugh-Veitch-diagram [3P]
d) Draw the logic gate map for simplified table (use 

for AND, 

for OR,  for NOT) [2P]

30) What does the IEEE 754 describe? Give a schematic representation! [4P]

31) Give four floating point attributes in a numerical limited system. [5P]

32) Give a short definition for deterministic chaos and explain an example where it can easily appear in a deterministic, numerical computer world. [3P]

33) Give four number systems (including the bases) used in computer science? [4P]

34) What is the difference between ASCII and binary representation of a number? [2P]

35) Remember ASCII-Code: Write a Matlab-program converting the ASCII-representation of „246“ (a=`246`;) into an equivalent decimal output 246 (ans=246;) without using a maybe given Matlab-function doing that for you. [6P]

36) Remember ASCII-Code: How can you easily convert lower-case letters to upper-case one without using given functions like „toupper“ in C? Give the schematic steps! [3P]

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37) What is a weaver (graphical scheme)? For what can it be used (care about key words)? [4P]

38) What is UML? [3P]

39) Give 5 guidelines from design rules, you have heard in the lecture? [5P]

40) What is the difference between sequential lists and ordered linked lists? [2P]

And:

Some questions about the practical training as:

a) Remember the programming of motor drivers: how can you reach a smooth step-wise forward movement of the robot, which has two motors?
b) Remember the programming: how can you program a stop routine for the robot, which stops all its operations?
c) How can you set a pin as an output port?
d) How can you print something to the serial monitor (describe the setup and the printing)?
e) How can you include foreign modules?

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