Computer Science 1631 Midterm

Friday October 13, 2006 Name(Print)_____

Part A. True/False Indicate whether the statement is true or false by placing an X in the box next to the question.

T	F	
__	X	1. Computer science is the study and use of computers and computer programs
__	X	2. The five generations of modern computers are distinguished mainly by fundamental changes in the underlying computer architecture.
__	X	3. All conceivable problems can be solved algorithmically.
__	X	4. The first electronic programmable computer, ENIAC, was built during World War I.
X	__	5. Pseudocode is a special set of English language constructs modeled to look like the statements available in most programming languages.
X	__	6. Having an infinite loop in an algorithm is an error.
__	X	7. Computer algorithms are limited to accepting only two values as input.
__	X	8. It is sufficient for an algorithm to provide correct results for only the input values that we expect are the most likely to occur.
X	__	9. Sequential search is an order-n algorithm in the average case.
__	X	10. The selection sort algorithm can recognize whether or not the list is already sorted at the beginning.
__	X	11. Binary search uses significantly more space than sequential search.
X	__	12. Some algorithms must do work that is not polynomially bounded.
__	X	13. Information is stored in the memory of a computer using the decimal numbering system.
__	X	14. The Boolean AND is a unary operator.
__	X	15. The sum-of-products algorithm always produces an optimal circuit.
X	__	16. To construct an OR gate, two transistors are connected in parallel.
X	__	17. The RAM of a computer provides volatile storage.
__	X	18. As computers become faster, memory access speeds are keeping pace.
__	X	19. In a two-level memory hierarchy, when the computer needs a piece of information, it looks in RAM first, then cache memory.
X	__	20. Registers can be accessed much more quickly than random access memory.

Part B. Multiple Choice Identify the choice that best completes the statement or answers the question by placing an X in the box next to the question.

a. b. c. d.

__ __ __ X 1. An operation that is unambiguous is called a _____ operation of the computing agent carrying out the algorithm.
a. primary
b. complementary
c. basic
d. primitive

X __ __ __ 2. In 1946, John Von Neumann proposed a radically different computer design based on a model called the _____
a. stored program
b. external program
c. programmable function
d. memory unit

__ __ X __ 3. Babbage's analytical engine used a mill. What was its function?
a. store memory
b. process instructions
c. perform arithmetic and logic
d. accept input

__ __ __ X 4. A _____ is the repetition of a block of instructions.
a. cycle
b. nucleus
c. matrix
d. loop

__ __ X __ 5. In a posttest loop, the continuation condition is tested at the _____ through the loop.
a. beginning of each pass
b. beginning of just the first pass
c. end of each pass
d. end of just the last pass

__ __ X __ 6. _____ is the process of searching for a special pattern of symbols within a larger collection of information.
a. Sequential search
b. Dynamic processing
c. Pattern matching
d. Pattern search

__ X __ __ 7. Consider this line of code: Set the value of Area to length*width "Area" is a _____ .
a. value
b. variable
c. constant
d. primitive

__ __ __ X 8. How could an algorithm fall into an infinite loop?
a. the input operations were missing
b. the algorithm uses more than one loop
c. the output operations were missing
d. the continuation condition of the loop never becomes false

X __ __ __ 9. The _____ case of an algorithm requires the minimum amount of work.
a. best
b. worst
c. smallest
d. largest

__ __ __ X 10. Selection sort is $a(n)$ _____ algorithm in all cases.
a. 1
b. $Q(n)$
c. $Q(2^n)$
d. $Q(n^2)$

_ _ _ X 11. An _____ algorithm is called an exponential algorithm.
a. $Q(lgn)$ c. $Q(n^2)$
b. $Q(n)$ d. $Q(2^n)$

X _ _ _ 12. _____ is the fixing of errors uncovered through repeated use of an algorithm.
a. Program maintenance c. Data cleanup
b. Recycling d. Garbage collection

_ X _ _ 13. ASCII uses _____ bits to represent each character.
a. 4 c. 16
b. 8 d. 32

_ _ X _ 14. $A(n)$ _____ is a single point sampled from a photographic image and stored in the digital format.
a. pitch c. pixel
b. amplitude d. bit

_ _ X _ 15. The _____ operation complements the value of a Boolean expression.
a. NOR c. NOT
b. OR d. AND

_ _ X _ 16. Using the leftmost bit of a number to represent the sign, with 0 meaning positive and 1 meaning negative is known as _____ notation.
a. ones complement c. sign/magnitude
b. twos complement d. unsigned

X _ _ _ 17. If a computer has a maximum of 2N memory cells, then each address field in a machine language instruction must be _____ bits wide to enable us to address every cell.
a. N c. N^2
b. 2N d. 2^N

_ _ X _ 18. The _____ machine language instructions alter the normal sequential flow of control.
a. data transfer c. branch
b. arithmetic d. compare

_ _ X _ 19. How many bytes are in a gigabyte?
a. 2^{10} c. 2^{30}
b. 2^{20} d. 2^{100}

_ X _ _ 20. To alert the computer that an input/output operation is done, $a(n)$ _____ is transmitted to the processor.
a. condition code c. broadcast
b. interrupt signal d. execution instruction

Part C. Long Answer.

1. [10] a) Perform a selection sort on the list 7, 4, 2, 9, 6. Show the list after each exchange that has an effect on the list ordering.

7, 4, 2, 6, 9

6, 4, 2, 7, 9

2, 4, 6, 7, 9

6 marks

b) How many exchanges occur in applying selection sort to a list of n items if the list is initially in decreasing order? Assume n is divisible by 2. Explain your answer.

n/2 exchanges occur since the first and last items are exchanged, the second and second-last, and so on through half of the list

4 marks

2. [10] a) Assume a 24-bit MAR is organized with 12 row-select lines and 12 column-select lines. What is the maximum size of the memory unit on this machine? Assuming a square two-dimensional organization, what are the dimensions of the memory.

Max memory size 2^{24} bits (16Mb)

Memory dimensions $2^{12} \times 2^{12}$ (or 4096×4096)

4 marks

b) Name the three components of the Von Neumann architecture and explain what each one does (at most one sentence per component).

memory

I/O unit

central processor.

(See text for functions)

3 marks

c) What functions are performed by each step of the fetch-decode-execute cycle (at most three sentences)?

fetch - loads instruction from memory

decode - determines what instruction does

execute - does the instruction.

3. [10] For the following truth table

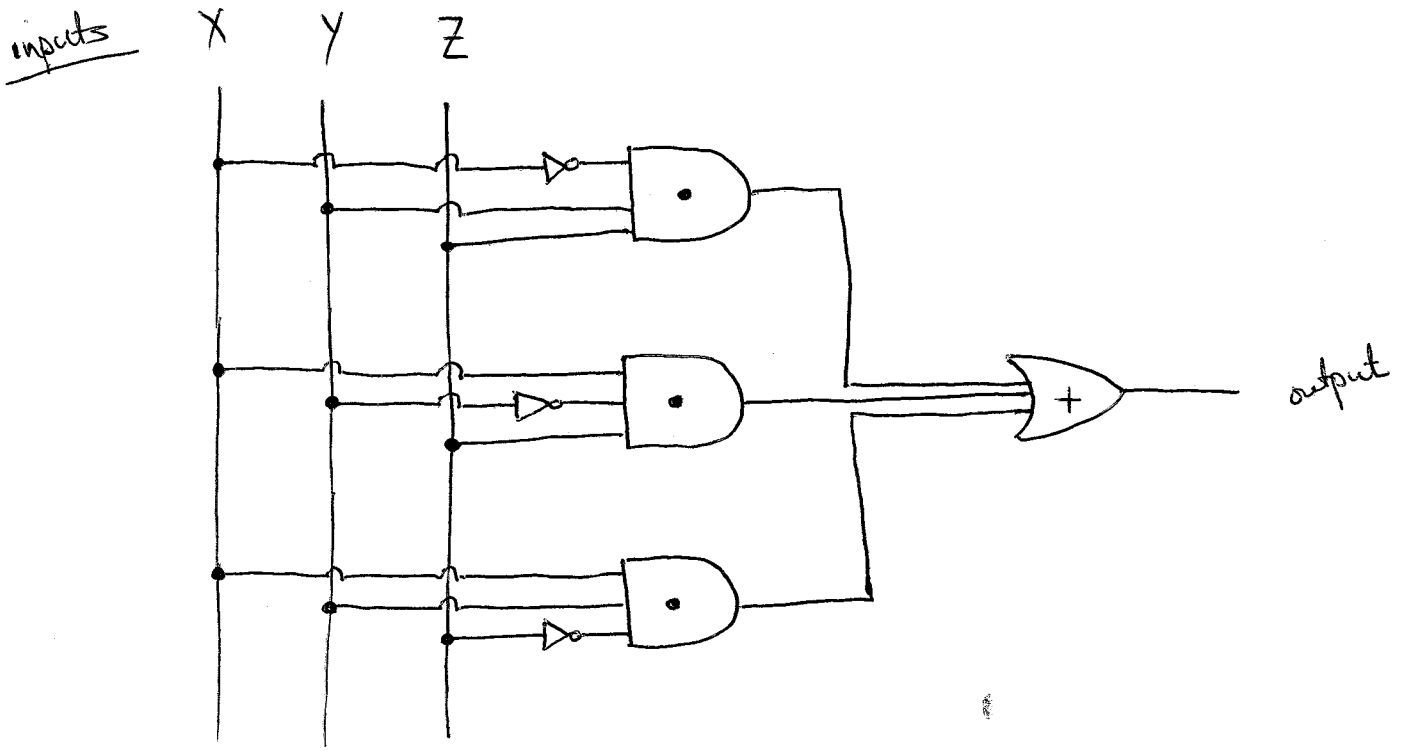
X	Y	Z	Result
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Isolate rows with output = 1

a) Write the corresponding Boolean expression in sum-of-products form.

$$(\bar{X} \cdot Y \cdot Z) + (X \cdot \bar{Y} \cdot Z) + (X \cdot Y \cdot \bar{Z})$$

b) Draw a circuit that implements the Boolean expression from part a).



Note: The text uses AND/OR gates with only 2 inputs, but since the lab software let them take 3 inputs, this is acceptable.

4. [10] Write a pseudo-code algorithm for the following problem: Ask the user for a number n and then set the value of a variable evensum to the sum of all the even numbers between 1 and n inclusive.

1. Get value for n
2. Set value of evensum to 0
3. Set value of i to 2
4. While (i <= n) do steps 5 and 6
5. Set value of evensum to evensum + i
6. Set value of i to i + 2
7. Stop