Assignment 3
(**Due date: 2/26/2010, Friday, in class**)

Your name:	Grade:

Important notice on how to submit and grade this assignment:
- Write your answers on **different papers** from this question sheet; otherwise, they will **NOT** be graded.
- You do **NOT** have to write the question text, but you need to **write the question numbers**.
- Put your solutions in the **same order** as the questions appear on the assignment; otherwise, **missed or misplaced** solutions will **NOT** be graded.
- **How to Grade:**
  - The total score for the assignment is **100** points.
  - **An extra 5%** will be added to the **TYPEWRITTEN** submissions.
  - **3 points will be deducted** from your total score if you **missed any ONE** of the following (this is a *cumulative penalty*, e.g., 9 points will be taken for 1 missed name and 2 missed required blank lines):
    - **Your name** and **assignment number** on the top of each solution sheet/paper,
    - At least **one blank line** between solutions of adjacent questions.

1. The steps that the LMC performs are closely related to the way in which the CPU actually executes instructions. Draw a flow chart (like the ones shown in the class) that describes the steps t hat the LMC follows to execute a branch (**branch-always**) instruction.

2. Draw a flow chart that describes the LMC follows to execute a subtract instruction.

3. What are the criteria that define a von Neumann architecture?

4. What is the difference between an assembler and a compiler?

5. What is the difference between a declarative statement and an imperative statement?

6. List some common data types and describe how to use them for representing personal information such as *ages, height, name…*?

7. Identify some common control structures found in imperative and object-oriented programming languages.

8. What is the difference between a global variable and a local variable?

9. What is the difference between a procedure and a function?

10. Draw the parse tree for the expression: x * y + x + z. (* is multiplication operator).

11. What is the difference between an object and a class?

12. Suppose t he classes *PartTimeEmployee* and *FullTimeEmployee* inherited the properties of the class *Employee*. What are some features that you might expect to find in each class?

13. Figure 6.2 (available from slides for the Chapter 6) provides a diagram that describes the evolution of programming paradigms. Put each of the programming languages in that diagram in the following table:

	Functional	Object-oriented	Imperative	Declarative
1950				
1960				
1970				
1980				
1990				
2000				

14. What is BNF? Explain why and how the following personal mailing address is an example of US-Post-Address BNF defined by the following diagram?

John Smith Jr.
352 Lafayette Street
Salem, MA 01970

```
<postal-address> ::= <name-part> <street-address> <zip-part>

    <name-part> ::= <personal-part> <last-name> <opt-jr-part> <EOL>
                 | <personal-part> <name-part>

 <personal-part> ::= <first-name> | <initial> "."

<street-address> ::= <opt-apt-num> <house-num> <street-name> <EOL>

     <zip-part> ::= <town-name> "," <state-code> <ZIP-code> <EOL>

  <opt-jr-part> ::= "Sr." | "Jr." | <roman-numeral> | ""
```

15. What is EBNF? Provide an example about EBNF.

16. Briefly describe the roles of Linker and Loader in the category of system software.

17. The following is a diagram for a 4x3 memory. $I_0I_1I_2$ are data inputs; A_1A_0 are used for memory address selection; **RD is for Read (when RD =1) and Write (when RD =0)** control; *CS* and *OE* are always 1 (selected); $O_0O_1O_2$ are output bits (the propagation delays of the logic gates can be ignored because we are testing the circuits in time of seconds or minutes).
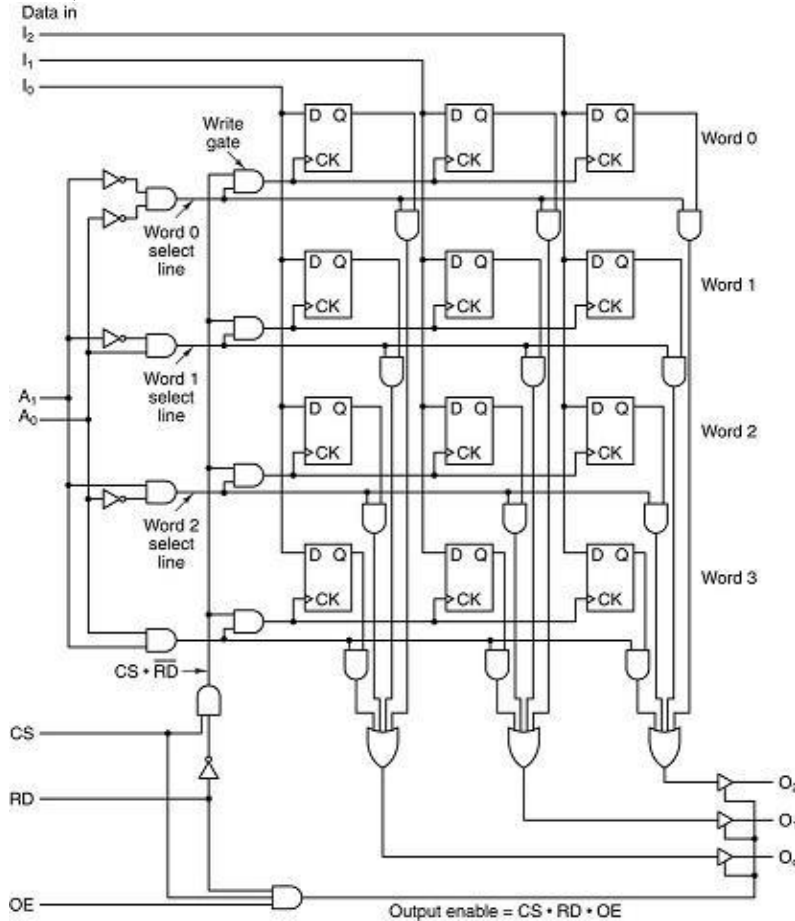
Fill out the following table (if the contents cannot be determined, put "N/A" in the box).

Inputs				Memory/Output				
Time	RD	A_1A_0	$I_0I_1I_2$	Word0	Word1	Word2	Word3	$O_0O_1O_2$
T_0	0	00	110				N/A	N/A
T_1	0	10	011					
T_2	1	10	N/A					
T_3	0	10	010					
T_4	1	00	101					
T_5	1	10	N/A					