1. (10%) Given a tree, how many different ways can be applied to traverse the tree. To uniquely determine a tree, how many (at lease and exactly) tree traversal sequences are needed? Please give a formal proof of your answer.

2. (10%) What is the difference between trap and interrupt?

3. (10%) What is the Inverted Page table?
   Please explain why it is difficult to implement shared memory by Inverted Page table.

4. (a) (8%) In general, software size can be described by length, functionality and complexity. Lines of Code (LOC) is one of the most common and used metric to estimate software size. It includes all lines containing program headers, declarations and executable and non-executable statements. Please list two advantages and two disadvantages of using LOC. (8%)

   (b) (8%) The following table shows the data collected to assess quality and productivity for three young programmers A, B and C.

Programmer	Software Development LOCs per month	Code Reuse Proportion	Coupling level	Cohesion Ratio	Cyclomatic complexity
A	1000	20%	0.8	0.2	10
B	1500	10%	0.2	0.8	12
C	3000	50%	0.5	0.5	20

   i. Which one of the programmers has a higher productivity? Why?

   ii. Which one of the programmers produces better quality code? Why?

5. (a) (5%) Please compare polled I/O and interrupt-driven I/O.

   (b) (10%) State the difference between NMI and IRQ. Why can't NMI be used to handle interrupt requests from I/O peripherals.

6. (15%) Please briefly define or explain the following terms.

    (a)   Entity-Relationship Diagrams

    (b)   Design Pattern

    (c)   IPv6

    (d)   Data Warehouses

    (e)   BIOS

7. (a) (5%) Currently many desktop motherboards provide RAID function. Please briefly describe how a RAID can be used to improve the fault tolerance of the system.

(b) (5%) What is RAID 10? How many disk drives (at least) are needed for RAID 10? Why?

(c) (5%) SCSI, SATA and IDE are usually considered the best solution for cost-effective, high-performance, and low-I/O workload applications. Please define and explain the three terms, SCSI, SATA and IDE. Besides, what is the speed difference between SATA and SCSI?

8. (9%) Assuming that j has the value 1, $a[1]$ the value 2 and $a[2]$ the value 3, what would be the effect of the call $swap(j, a[j])$ when the parameters are passed (a) by reference, (b) by value-result, (c) by reference? Notice that explanation is necessary. No explanation will be treated as zero mark directly.

```
Procedure swap(var first, second: integer);
var intermediate: integer;
begin
    intermediate := first;
    first := second;
    second := intermediate
end {swap};
```