



5. In the following properties of Object Oriented Program (OOP), simply explain and indicate the major advantage of each property. (10%)

- a. Abstraction:
- b. Information hiding:
- c. Overload:
- d. Polymorphism:
- e. Inheritance:

6. Function  $\text{factorial}(n) = n! = 1 * 2 * \dots * (n-1) * n$ . Write both non-recursive function and recursive function for  $\text{factorial}(n)$  using C language. (10%)

7. Assuming A is an **array**[1..n] of recordtype and n is the number of records in the following bubblesort algorithm, (a) indicate the computing steps for each statement. (b) Then calculate total computing steps and (c) simplified it into software complexity (Big-Oh). (10%)

```
for(i=1;i<=n-1;i++){
    for(j=n;j<=i+1;j--){
        if (A[j].key < A[j-1].key){
            temp=A[j].key;
            A[j].key=A[j-1].key;
            A[j-1].key=temp;
        }
    }
}
```

8. The relationships between family members are indicated in the following PROLOG facts. Write a rule for each relationship (Problem a-d). (10%)

parent( pam, bob).	% Pam is a parent of Bob
parent( tom, bob).	parent( tom, liz).
parent( bob, ann).	parent( bob, pat).
parent( pat, jim).	
female( pam).	% Pam is female
male( tom).	% Tom is male
male( bob).	female( liz).
female( ann).	female( pat).
male( jim).	

(a) mother(X,Y):-

(b) grandfather(X,Y):-

(c) sister(X,Y):-

(d) has\_child(X):-

(e) predecessor(X,Y) means X is previous generation of Y. Use one fact and one recursive rule to indicate predecessor(X,Y).

9. Transfer the following E-R model into relation database scheme (6 tables, their attributes and their primary key). (10%)

