1.a. Define binding? (2 points)  
  
c. Give 3 examples of bindings and for each state: what is being bound, and when does the binding take place. (6 points)  
d. Define environment and what do they have to do with expression evaluation? Provide an example for illustration. (2 points)  

2. a. Define static scope. (3 points)  
b. define dynamic scope. (3 points)  
c. What is an activation record? (2 points)  
d. State all the types of data that an activation record contains. (6 points)  

3. Give an explicit expression that when is evaluated produces different answers based on the scope discipline used. Give the answers. You must clearly justify the evaluation by giving along with the evaluation the environment being used to evaluate the expression. (8 points)  

4. a. What is the purpose of a type system? (2 points)  
b. what are the requirements of what is expected in terms of types (5 points)  
b. List and define the two basic typing systems found in programming languages and their tradeoff. (10 points)  
   . Define type equivalence. (2 points)  
d. List trade-off points for name equivalence and structural equivalence. (6 points)  

5. What is a sum of types? what is the reason for it? how do unions and variant records fit into sums of types? how to make variant records type safe.  

. Ada records, or C structs are used to define user-defined types. Are they useful for the definition of such types or are they intended to be used for other purpose? what soft. eng principle is violated? (4 points)  

a. List all the possible parameters involved in the definition of an array (6 points)  

. In languages like C or Java, which of those parameters can be specified by the programmer and which ones by the language? (4 point)  
c. Answer b. for Ada’83 or Ada’95. (4 point)  
d. Define each of the following: (6 points)  
   static array  
   semi-dynamic array  
   dynamic array.  
e. For each type of array in d, name a language that supports it. (6 point)  
   static array  
   semi-dynamic array  
   dynamic array.  

7. a. What are recursive types? (4 point)  
b. Give two methods that languages offer to the programmer to define recursive types. (4 point)  

8a. Define dangling pointer. (4 point)  
b. Give two methods to avoid dangling pointers in languages with pointers. (4 point)  

9.a. Define ADT (3 point)  
b. How are ADT’s represented (6 point)  
   in Ada?  
   In Java?  
   In C?
c. From the point of view of specification and implementation of ADT’s what are the best programming language mechanism that should be supplied to aid in the definition of ADT? Also list the plusses and minuses of this mechanism. (8 points)
d. How does Java support encapsulation? (4 point)

11.a. What is genericity? (4 point)
b. For what kinds of language constructs we would like to have genericity?(6 point)
c. How is genericity of containers implemented (9 points)
   in Ada?
   in C++?
   in Java?
d. How is genericity of functionality implemented in ( 6 points)
   Ada?
   C++
   Java
   C