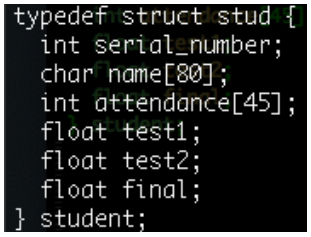
Tutorial 3

Structures

1. Create a structure that could be used to describe a point in polar coordinates.
2. Create a structure that could be used to describe a square.
3. Write a function that returns a structure as described in question 2 initialized to reasonable values.
4. Create an array of squares as described in question 2.
5. Define a new type called square that will held a square as described in question 2.
6. Write a function that will delete a square from the array described in question 4.

Linear Search



```
typedef struct stud {
  int serial_number;
  char name[80];
  int attendance[45];
  float test1;
  float test2;
  float final;
} student;
```

Illustration 1: defintion of “student” type.

7. Write a function the will perform a linear search on an array of students as defined in illustration 1, based on serial_number.
8. Write a function the will perform a linear search on an array of students as defined in illustration 1, based on namer.
9. Write a function the will perform a linear search on an array of students as defined in illustration 1 that will find the student with the highest grade on the final.
10. Write a function that will perform a linear search on an array of students as define in illustration 1 that will find the student with the highest average of test1, test2, and final.
11. Prove than the complexity of linear search is ($O(n^2)$).

Binary Search

12. Write a function that will perform a binary search on an array of integers, declared as. “int find (int value, int a[], int length), that will return the index of a value in array a. It need only find one value.
13. Trace the “find(5, a, 10) if a is {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.
14. Trace the “find(8, a, 10) if a is {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.
15. Trace the “find(4, a, 10) if a is {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.
16. What is the complexity of binary search? Prove it.