**Problem Solving Applied: Freezing Temperature of Seawater:**

Basics: he **salinity** of seawater is a measure of the amount of dissolved material in the seawater. **Seawater** is primarily water with about 3.5% dissolved materials (salts, metals, and gases) . **ote:** The higher the salinity, the lower the temperature at which the seawater freezes.

The following table contains a set of salinity measurements and corresponding freezing temperatures:

Salinity (ppt)	Freezing Temperature (°F)
0 (fresh water)	32
10	31.1
20	30.1
24.7	29.6
30	29.1
35	28.6

Figure 2.6 *Freezing temperature of seawater.*
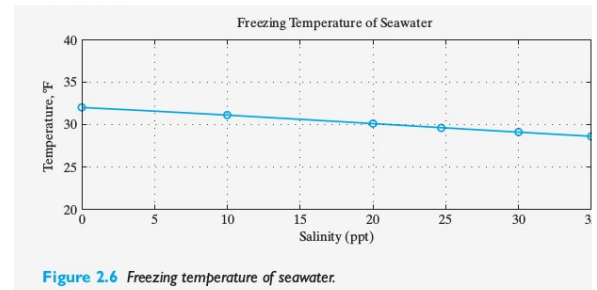
1. PROBLEM STATEMENT
**Use linear interpolation to compute a new freezing temperature for water with a specified salinity**

2. INPUT/OUTPUT DESCRIPTION
The following diagram shows that the input to the program includes two consecutive points **(a, f (a)) and (c, f(c))** and the new salinity measurement b, while the output is the new freez- ing temperature:

Example : If a is salinity and then F(a) is Freezing temperature (From the **graph**)

New freez- ing temperature **(f(b)** for New salinity measurement b is given by :

$$f(b) = f(a) + (b - a)/(c - a) * (f(c) - f(a))$$
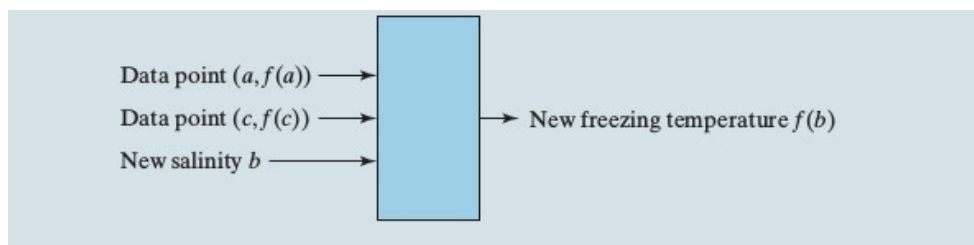
3. HAND EXAMPLE
Suppose that we want to determine the freezing temperature for water with a salinity meas urement of 33 ppt. From the data, we see that this point falls between 30 and 35 ppt:

a	30	29.1	f(a)
b	33	?	f(b)
c	35	28.6	f(c)

Using the linear equation formula, we can compute $f(b)$:

$$f(b) = f(a) + (b - a)/(c - a) \cdot (f(c) - f(a))$$
$$= 29.1 + 3/5 \cdot (28.6 - 29.1)$$
$$= 28.8.$$

4. ALGORITHM DEVELOPMENT

1. Read the coordinates of the adjacent points and the new salinity value.
2. Compute the new freezing temperature.
3. Print the new freezing temperature.

```c
#include <stdio.h>
#include <math.h>
int main(void)
{
    double a, f_a, b, f_b, c, f_c;
    printf ("Use ppt for salinity values. \n");
    printf ("Use degrees F for temperatures.
    \n");
    printf ("Enter first salinity and freezing
    temperature: \n");
    scanf ("%lf %lf",&a,&f_a);
    printf ("Enter second salinity and freezing
    temperature: \n");
    scanf ("%lf %lf",&c,&f_c);
    printf ("Enter new salinity: \n");
    scanf ("%lf",&b);
    f_b = f_a + (b-a)/(c-a)*(f_c - f_a);
    /* Print new freezing temperature. */
    printf("New freezing temperature in degrees
    F: %4.1f \n",f_b);
    /* Exit program.
    return 0;
  */
}
```

5. TESTING

We first test the program using the data from the
hand example.

```
Enter first salinity and freezing temperature:
30 29.1
Enter second salinity and freezing temperature:
35 28.6
Enter new salinity:
33
New freezing temperature in degrees F: 28.8
```

The value computed matches the hand example.