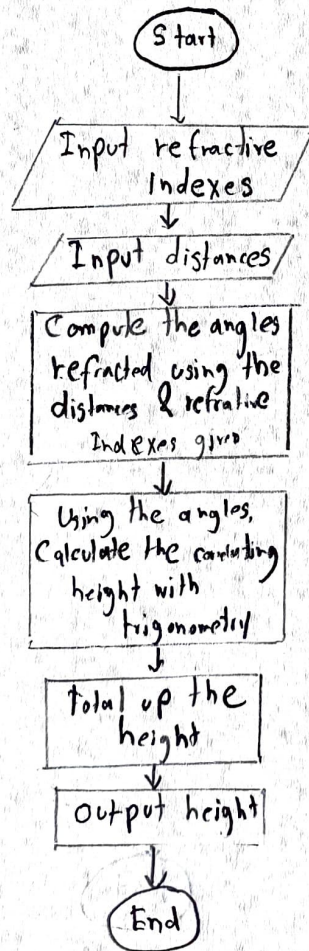
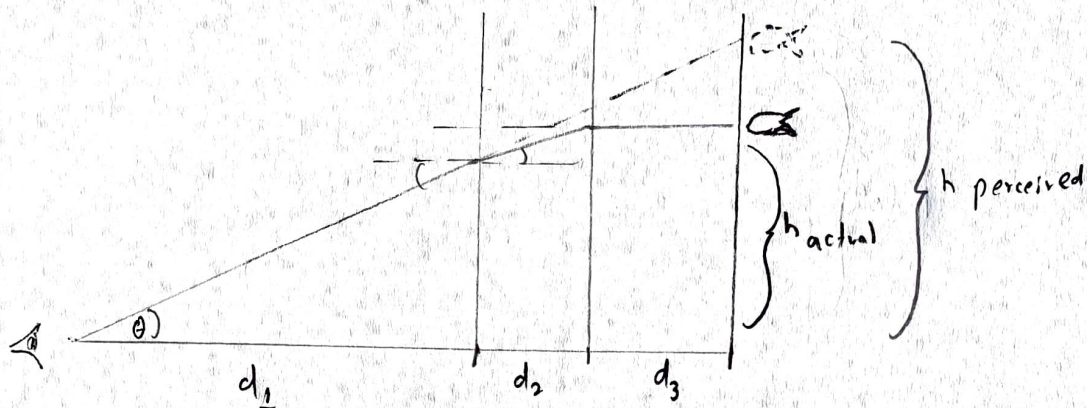


Problem Statement: Develop a program that will accurately give the actual height of a fish when given the refractive indexes of air, glass, and water, as well as the distance from the viewer from the glass, the thickness of the glass, the distance from the fish to the glass, and how high up the fish is in the viewer's perspective.

Diagram:



Theory

$$\sin(a) = \frac{A}{C}$$

$$\tan(a) = \frac{A}{B}$$

$$\text{Law of refraction : } n_a \sin(\theta_a) = n_b \sin(\theta_b)$$

Assumptions

- ① Glass is completely flat
- ② Fish is stationary
- ③ Person has good vision
- ④ Given measurements are exact
- ⑤ Everything is perfectly perpendicular to the ground.
- ⑥ The fish and the person is lined up perfectly.

Solution:

See file 4p1-HW-Task1-gamage.td.vi

Verification

Test case	Expected result	Actual Result
Height = 1 ft, $n_{\text{air}} = 1.00$, $n_{\text{tank}} = 1.69$ $n_{\text{water}} = 1.33$, $D_{\text{person}} = 2 \text{ ft}$, $D_{\text{fish}} = 1 \text{ ft}$ $D_{\text{tank}} = 0.5 \text{ ft}$	0.865 ft	0.8644 ft
Height = 0.5 ft, $n_{\text{air}} = 1.00$, $n_{\text{tank}} = 1.9$, $n_{\text{water}} = 1.2$ $D_{\text{person}} = 2 \text{ ft}$, $D_{\text{fish}} = 1 \text{ ft}$, $D_{\text{tank}} = 0.5 \text{ ft}$	-0.44 ft	-0.44 ft

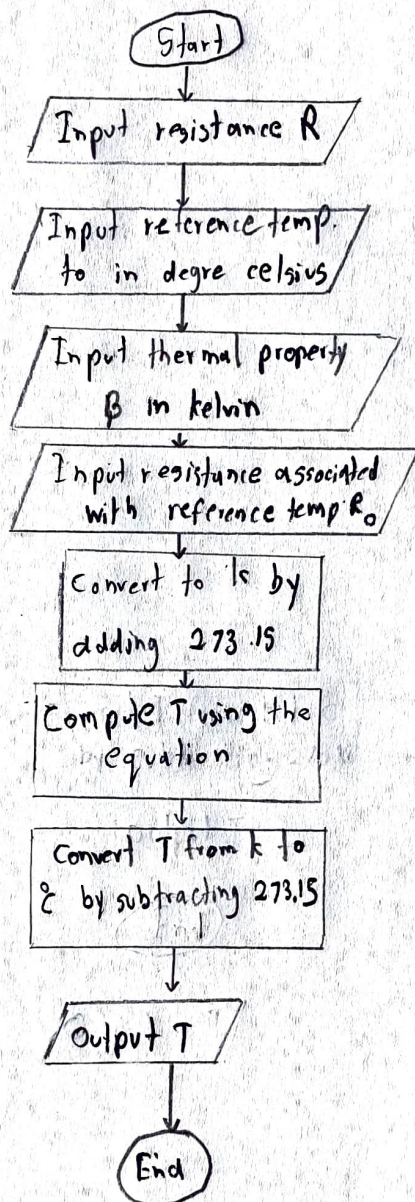
⇒ The program passes.

Conclusion.

A program to determine the actual height of a fish using refractive indexes of air, glass & water and the perceived height of the fish works by computing the angles refracted with trigonometry, and finally displaying the total, or actual heights.

Problem statement: Write a program that would determine the temperature in degree Celsius of a liquid in a pipe using the thermistor's resistance, reference temperature/resistance pair and the thermal property of the material

Diagram:



Theory

$$T = \frac{\beta T_0}{T_0 \ln\left(\frac{R}{R_0}\right) + \beta}$$

$$K = ^\circ C + 273.15$$

Assumptions:

- ① T cannot be smaller than or equal to 0K.
- ② Resistance must be larger than 0.

Solution:

See file 4p1_HW_Task2_gamagetd.vi.

Verification

Test case:	Expected value	Actual value
$P = 50k, T_0 = 100^\circ C, R_0 = 200\Omega$ $R = 150\Omega$	$-598.485^\circ C$	$-598.485^\circ C$
$\beta = 3969k, T_0 = 85^\circ C, R_0 = 1075\Omega$ $R = 1075\Omega$	$85^\circ C$	$85^\circ C$

⇒ Pass

Conclusion

The program determined the temperature of a liquid inside a pipe by first converting all input temperatures to kelvin, calculating T using the formula of the thermistor, and then converting T back to degree celsius before outputting the final answer of T .