# Project 2: Linear Interpolation

## Introduction

Linear interpolation is a method of curve-fitting where a new data point is "fit" between two known data points. Consider a point $a$ with coordinates $(t_a, y_a)$ and a point $b$ with coordinates $(t_b, y_b)$ as shown in Figure 1. Given a particular value of $t$, $t_i$, the y-coordinate, $y_i$, of the intermediate point $i$ can be found using a line segment connecting points $a$ and $b$. The following equation ensures that point $i$ is on the line segment between $a$ and $b$

$$\frac{y_i - y_a}{t_i - t_a} = \frac{y_b - y_a}{t_b - t_a} \tag{1}$$

by making the slope between points $a$ and $i$ the same as between points $a$ and $b$. Equation (1) can be solved for $y_i$ given below

$$y_i = \frac{y_b - y_a}{t_b - t_a}(t_i - t_a) + y_a. \tag{2}$$

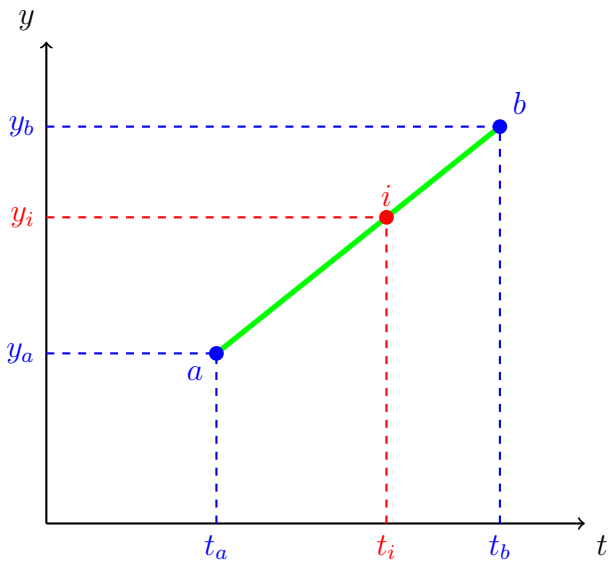


Figure 1: Concept of a linear interpolated point $i$ between points $a$, $b$

### Problem Statement

The goal of the project is to write a C program that performs linear interpolation. Specifically, the C program should

1. read in a data file where each line is a given pair (i.e., $t$, $y$) of data separated by a comma;
2. read in a set of $t$-values (one on each line) from another data file for which $y$-values are unknown, but desired;
3. use the given pairs (on either side of the desired value) and linear interpolation via equation (2) to find the desired $y$-values that correspond to $t$-values given;
4. write the results of all interpolations to one data file where each line contains the pair $t_i$, $y_i$ separated by a comma;
5. be easily modified for other data files of different lengths; and
6. be neatly coded, i.e., has appropriate variable names, nice formatting and comments.

### Items to Turn In

- Hand in a printed document that includes memo (note your deliverable is the C program this time versus a specific result), C program, and results for the data files (knownty.txt, desiredt.txt) given.
- Email C program to instructor such that program can be readily compiled and executed, and alternate data files tested. Put "EE 251 Project 2" in the subject line of the email.