Assignment 5: Cable Tension

Objective
To develop an algorithm and write a Fortran program to calculate the tension in a cable.

Description
A 200 kg object is to be hung from the end of a rigid 3 meter horizontal pole of negligible weight, as shown in Figure 1. The pole is attached to a wall by a pivot and support by a 3 meter cable attached to the wall at a higher point. The tension on the cable is given by the equation:

$$T = \frac{W l_c l_p}{d\sqrt{(l_c^2 - d^2)}}$$

where: T is the tension on the cable, W is the weight of the object, l_c is the length of the cable, l_p is the length of the pole and d is the distance along the pole at which the cable is attached.

Complete the following:

1. Using this information write an algorithm for a Fortran program to determine the distance *d*, at which to attach the cable to the pole in order to **Minimise** the tension on the cable. To do this, the program should calculate the tension on the cable at 0.1 meter intervals from d = 0.5m to d = 2.8m and locate the **position *d*** that produces the **Minimum Tension.** Write the tension *t* and position *d* to an output data file. This file should also include the Minimum Tension, $T_{\min}$ at the corresponding position *d.*
2. Write the program for the solution to the problem
3. Import the output data file into MS Excel™, then:
    a. Tabulate the tension and position data, giving the data to 2 decimal points.
    b. Plot a graph of the tension against position (see example in Figure 2)
4. Mark the Minimum Tension on the graph.

Report
The report should include the following:

1. Algorithm for the solution to the problem
2. Fortran program
3. Table of data (Position; Tension)
4. Excel graph of tension against position, with the min tension highlighted
5. State the Min Tension and position at corresponding point

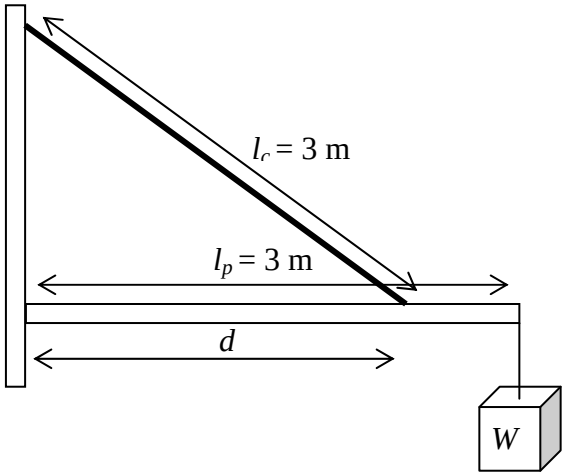

Figure 1: Weight suspended from a rigid bar supported by a cable

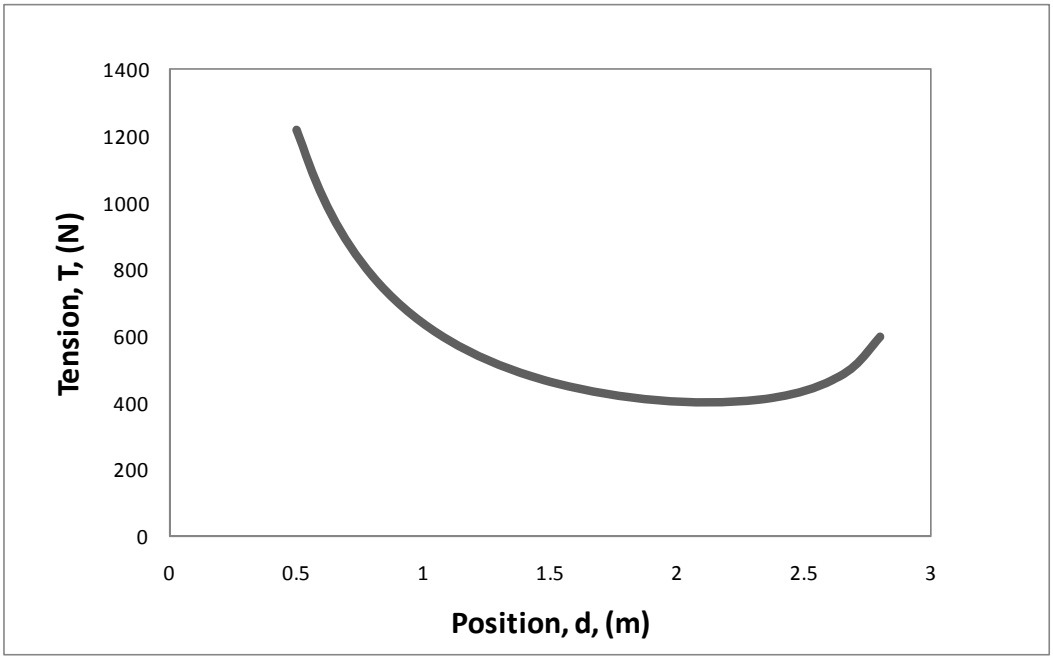

Figure 2: Sample graph Tension vrs Position