

## Assignment 2: Excel Functions

**Date Due: February 2, 2012**

Instructor: Trani

**Show all your work including VBA code and results of your computation in the spreadsheet as screen captures.**

### Problem 1

A civil engineer in charge of an airport project created a model to predict the passenger demand for Chicago Midway airport (MDW). The formula that calculates the demand ( $D$ ) of passengers boarding at the airport is:

$$D = \frac{C}{1 + b * e^{-at}}$$

where:

$D$  is the demand of passengers at time ( $t$ ). In this equation,  $t$  is measured as the year since year 1976 (the first year when data was collected at the airport). The units of  $D$  are passengers per year.

$C$ ,  $b$  and  $a$  are coefficients of the logistic regression model to predict demand. The values of these coefficients are:  $1.5e7$ ,  $36.0$  and  $0.1328$ , respectively.

- a) Create an Excel Function (using Visual Basic For Applications) to calculate the passenger demand at the airport for year  $t$  (i.e., year since 1976).
- b) Use the function created in part (a) to estimate the passenger demand from year 1 to year 60 (that means from 1976 until the year 2035). Create a table of results in the spreadsheet.
- c) The Excel file provided contains the actual demand for passengers using the airport from 1976 until the year 2006. Plot the data and the results of the model in the same graph and compare the results. Comment on the results observed.

### Problem 1

A set of formulas to calculate the deflection ( $y$ ) of a beam at a given station and the maximum deflection ( $\delta_{\max}$ ) of the same cantilever beam subjected to a tapering load applied through the length of the beam are shown below. The beam diagram showing the situation is shown in Figure 1.

$$y = \frac{W_0 x^2}{120l(EI)} (10l^3 - 10l^2 x + 5lx^2 - x^3)$$

$$\delta_{\max} = \frac{W_0 l^4}{30EI}$$

and  $W = \frac{W_0}{l}(l - x)$  as the formula to estimate the tapering load at any station ( $x$ ).

where:

$y$  is the deflection at any point along the beam (meters)

$x$  is the distance from the support point of the beam to any point in the beam (meters)

$l$  is the length of the beam (meters)

$W_0$  is the maximum load applied at the end point (N/m)

$E$  is the Young's modulus of elasticity ( $\text{N/m}^2$ )

$I$  is the beam moment of inertia ( $\text{m}^4$ )

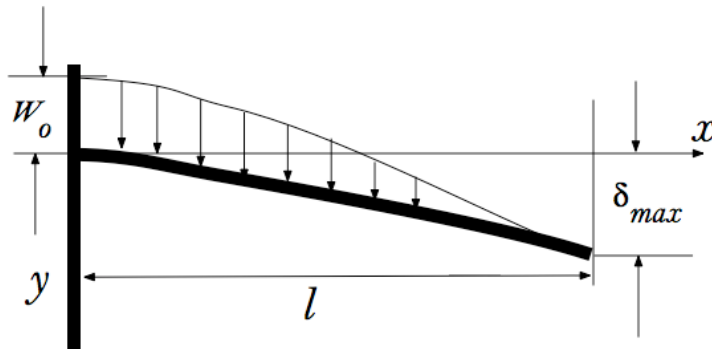


Figure 1. Cantilever Beam Subject to a Tapering Load.

- Create an Excel Function (using Visual Basic For Applications) to calculate the deflection of a beam. The function should take the characteristics of the beam shown above and produce a single value output: the deflection ( $y$ ). The function created in Excel needs to have the following arguments in the function list:  $x$ ,  $l$ ,  $W_0$ ,  $E$  and  $I$ . These are inputs needed to estimate the deflection  $y$ .
- Use the function created in part (a) to estimate the deflections of a 9 meter steel beam at points along the beam spaced every 0.1 meters. Use the following numerical values:  $W_0 = 6000 \text{ N/m}$ ,  $E = 200\text{e}9 \text{ (N/m}^2\text{)}$  and  $I = 0.0001 \text{ (m}^4\text{)}$ .
- Plot the solutions obtained in part (c) and label accordingly.
- For the beam described in part (b) estimate the maximum deflection at the end point of the beam.
- Create a second Excel Function to calculate the maximum deflection ( $\delta_{\max}$ ) of the beam of the type described above. This new function needs to have the following arguments:  $l$ ,  $W_0$ ,  $E$  and  $I$ . Find the maximum deflection for the beam described in part (a).

### Problem 3

Use the construction company assets file provided in class (see syllabus page) and answer the following questions using Pivot Tables. Clearly present the results of the pivot tables as a screen capture in your homework solution paper.

- Find the average value for the Caterpillar 775F vehicles at all three sites.
- Find the average number of miles for Caterpillar Cat 725 equipment at the Raleigh office.
- Find the total number of miles for Cat 160H owned by the company?
- What is the number of Cat 160H vehicles that are active at all three sites?

#### **Problem 4**

Use the construction firm Excel file in the syllabus page (see first week) and your knowledge of Excel DBASE functions to answer the following:

- a) Find the number of scrapers in the company.
- b) Find the number of scrapers whose value is greater than \$75,000.
- c) Find the average value of scrapers located in New York and whose value is more than \$70,000.
- d) Find the number of trucks in the Atlanta office currently receiving maintenance.
- e) How many loaders are in maintenance at the company?

IN your solutions show screen captures of the section of the spreadsheet that contains the queries