Quiz 2

Date: April 7, 2017 Instructor: Trani

Write your solutions in a single Word document and convert to PDF file. Cut and Paste all your answers using screen captures. Show all your work. Label your file with your last name and CEE3804. Email the solution to vuela@vt.edu and to Carol Liang (yqliang@vt.edu).

Problem 1 (40 Points) - Show all your code

You are given the task to calculate the volume of earth material to be removed from a hill during the construction of a new road project. Figure 1 shows surveyed elevation points (red dots) on the hill contour where the cut is to be made. The elevations and stations of the surveyed points are shown below.

station = [0 10 20 30 40 50 60 70 80 90 100]; % in meters

elevation = [0 14 21 25 26 25 22 18 13 8 0]; % in meters

a) Create a Matlab script to approximate the hill contour shown in Figure 1 using a 4th order polynomial. Write down the coefficients of the polynomial.

elevation = A (station)^4 + B (station)^3 + C (station)^2 + D (station) + E

b) Add to the script created in part (a) the necessary Matlab code to estimate the area of the cut to be made. Use the numerical integration method that employs the Newton-Cotes method in Matlab.

c) Verify the answer obtained in part (b) using the trapezoidal rule method.

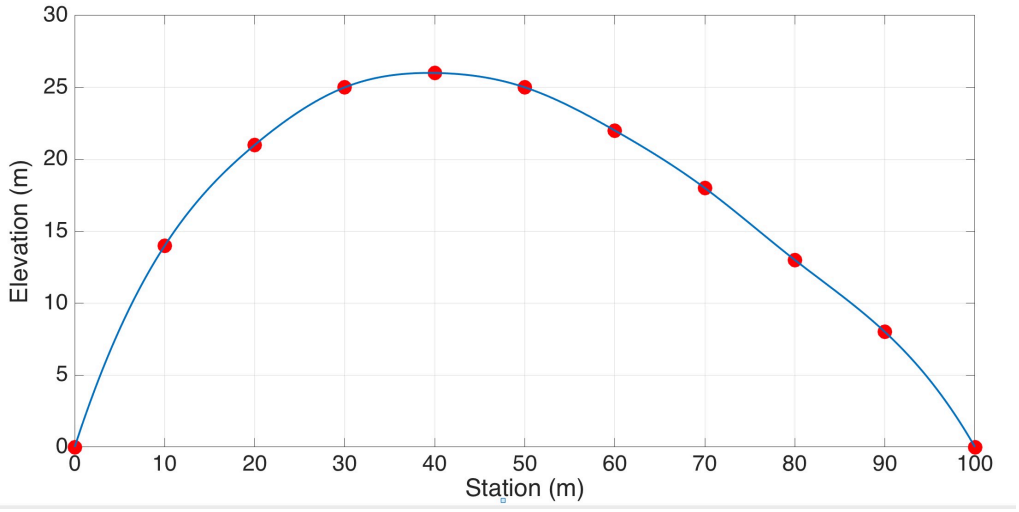

Figure 1. Elevation Profile of a Hill to be Removed in the Construction of a Road Project.

Problem 2 (30 Points) - Show all your code

Use Matlab to solve this problem

A person wearing a parachute jumps from a hovering helicopter at 2,500 meters above ground. Neglecting the lateral speed component of the jumper, the distance traveled (d) and the vertical speed (v) as a function of time (t) according to the following equation:

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speed = v0 * exp (-cd / m * t) + g*m/cd *(1- exp (-cd /m * t));

distance = g*t / (cd / m) - g/ (cd / m).^2 .* (1- exp (- cd / m * t)) + v0/( cd / m) .* (1- exp (- cd / m * t));
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where: the parameters m, cd, m, vo and g are defined as follows:

g = 9.81; % acceleration of gravity (m/s-s)

cd = 12.5; % drag factor (kg/s)

m = 68.1; % mass of the person (kg)

v0 = 0; % initial speed (m/s)

t = time in seconds

a) Create a regular Matlab script to estimate and plot the speed and distance traveled by the jumper from the moment of the jump to a point in time 30 seconds after the jump.

b) Plot both speed and distance versus time (time in the x-axis) in the same figure. Label accordingly.

c) Find the terminal speed of the jumper.

Problem 3 (30 Points) - Show all your code

The Excel file provided contains wind speed data for Chicago O'Hare International airport. A sample screen capture is shown below.

A	B	C	D
Date	Time_HrMin	Wind_Direction_deg	Speed_meters_second
20130101	0	330	3.1
20130101	51	340	4.6
20130101	105	330	4.6
20130101	151	360	4.6
20130101	251	350	5.1
20130101	258	350	5.1
20130101	325	360	4.6
20130101	341	340	5.7

a) Create a Matlab script to read the data provided in the Excel file.

b) Add Matlab code to find the percent (%) of time the wind speeds exceed 10 m/s. Display the result in the command window.

c) Estimate the number of observations when the wind direction is 50 degrees and the wind speed greater than 5 m/s.