LAB TEST 1: CITS2401 Computer Analysis and Visualisation
Semester 2, 2017

SESSION: Tuesday

Exam time 120 minutes
Maximum Marks: 40

- Please follow all instructions carefully.
- Submit your answers on LMS during the test session.
- You have to include all files into a single .zip file.
- Please ensure that you submit the correct files and function/script files run correctly.
- If you do not follow the submission guidelines then your submission will be graded zero.

No mobile phones
No 2-way internet communication

Submission

- Include your solution files in one folder. Right click on the folder and hover/click on "*Send To"* option, then click on "*Compressed (zipped) folder*". This will create a zip file.

- Rename you zip file to YourSurname_StudentNo.zip

- Submit the zip file via the CITS2401 page on LMS http://www.lms.uwa.edu.au. Weekly Modules → Week 13 → Lab Test 2

- Validate your submission by downloading it again and checking the files.

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Question 1: (4 marks) Matlab

Create a script file and write command(s) for the following tasks in the script file. All tasks are independent of each other. Don't forget to mention the task as the comment in the script file before its solution.

1. Write the statement(s) to integrate the following mathematical expression using symbolic computation in Matlab.

$$\int_{-10}^{10} [\sin(x) + cos^2(x)]\, dx$$

2. Write the statement(s) to differentiate the following mathematical expression ($\frac{\partial y}{\partial x}$) using symbolic computation in Matlab.

$$y = x^2 + 3z^2 - z\cos(x^2)$$

SAVE

- Save your script file with your YourSurname_StudentNumber e.g. *Weasley_122345.m*

Question 2: (16 marks) Matlab

Global warming, also referred to as climate change, is the observed century-scale rise in the average temperature of the Earth's climate system and its related effects. Multiple lines of scientific evidence show that the climate system is warming. Scientists are analysing the data and needs your computing skills.

Temperature anomalies of global mean surface temperature are collected into a two column CSV file. The first column represent the time in year while the second column provide the temperature anomalies. The first row of CSV file contains the titles of the columns. It is observed that considerable noise is added to the data. The data from 1880 to 2017 is collected and provided for examination to you.

You are required to write a function which can import the data from the CSV file. The name of the CSV file is provided as an input to the function. If you analyse the data in sample CSV file, you will find that data is provided for each year since 1880. The temperature anomaly represented by 9 shows that collected data is not available.

Your first task is to obtain the missing data, use interpolation to interpolate the experimental data using linear interpolation method. [Hint: use interp1]

Your second task is to find the coefficients of polynomial of degree 4 provided below that fits the data obtained after interpolation. Ignore the warnings posted by Matlab about badly conditional polynomial.

$$a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0 = 0$$

Plot the original data obtained from CSV file, data after interpolation and fitted polynomial obtained on a single plot. Don't forget the plotting guidelines mentioned in the lecture and equip the plot with all the details.

The function should return the total number of points which are corrupted in the CSV file and are replaced by interpolation.

The first line of the function must be

```
function [npts] = globalwarming(filename)
```

Include, as a comment in the second row of your function file, your full name and student number. The sample CSV file is provided with the name `Q1_data.csv`

SAVE

- Save your function file with name `globalwarming.m`

Question 3: (20 marks) Excel

The collected data for variation in global mean temperature for land and ocean is provided in the excel sheet (*Q2_Excel.xlsx*). This was recorded by National Aeronautics and Space Administration (NASA).

In the excel sheet, column A contains the year, column B to M contains the recorded anomalies for global mean temperature for each month of the year in Celsius. The first two rows are for writing your name and student ID. Row 4 provides the titles of the data provided in each column. From Row 5 onwards, each row presents the record for a year.

Your first task is to find the annual anomaly of global mean temperature by averaging the monthly anomalies of the year in Column N using cell array formula.

The calculated annual anomalies of global mean temperature in Column N can also be used to categorize the condition of global warming as presented in the table below.

Annual anomaly (A)	**Global warming category**
$A < -0.5$	Excellent
$-0.5 \leq A < 0$	Good
$0 \leq A < 0.5$	Careful
$0.5 \leq A < 1$	Needs improvement
$A \geq 1$	Emergency

Write a formula to find the category for each year in column O based on its annual anomaly.

In addition write a formula to count number of years which are categorized as “Careful” in Column O. Show your answer in **cell Q6.**

Plot the recorded anomalies for global mean temperature for the months of January, April, July and October for all years. Don’t forget the plotting guidelines mentioned in the lecture and equip the plot with all the details.

Remember, all work done should be generic and would update the results as soon as the provided data is changed. If you need to create new column(s) or use other areas of worksheet, feel free to use it.

SAVE

- Save your file with name YourSurname_StudentNumber e.g. *Weasley_122345.xlsx*