SCHOOL OF ADVANCED TECHNOLOGY

ICT - Applications & Programming
Computer Engineering Technology – Computing Science

Numerical Computing – CST8233

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Lab #3 – Functions, Statistics and Z-Scores

The main objective of this lab is to learn: 1) how to work with polynomial functions, and 2) how to develop statistics formulas using R language. Also, you will use z-scores to find the probability of certain events.

Objectives
- Read and follow the instructions, and
- Complete all steps.

    You will need to show your completed work to your lab professor to get your grades.

Grades:
2% of your final course mark

Deadline
During the lab period of Week 6.

PART I

Step 1. Working with Functions

In this step, you will use `PolynumF` package.

1. Install this package using `install()` function or just use the install option in the lower right panel of RStudio, i.e., the utilities panel.
2. Load this package using `require()` function.

You are given the following function:

$$p = x^3 - 3x^2 - 2x + 7$$

Define the independent variable as an object of class polynom using `polynom()` function. Then, assign the value of the given function to a dependent variable called `p`.

- What is the class of the variable `p`.? *Show how you find this to the lab professor*.

To find the coefficients of this function, you can use `coef()` function.

- Find these coefficients and *show them to the lab professor*.

`PolynomF` can calculate with only one polynomial variable at a time. Define another independent variable and called it y. You are given another function called `q` as follows:

$$q = y^2 + 2y$$

- Check the classes of both q and y.

- Find the result of p + q, p − q, and p * q.

Show your results to the lab professor.

In addition, `PolynomF` can calculate the derivative of polynomial function using `deriv()` function.

- Find the derivative of both `p` and `q`. Call these derivatives as `dpdx` and `dqdy`, respectively. *Show them to the lab professor.*

- Plot the functions p and dpdx on the same figure using `curve()` function for values of $-2 \leq x \leq 3$. Add a title of "p(x), dpdx" to the y axis. Use `Add` argument in the second curve function so that dpdx is added to the same plot.

- Add a horizontal line with a slope of zero and intercept of zero. Use `abline()` function.

Show your final graph to the lab professor.

Step 2. Statistics in R

We will work on a built-in dataset called "`airquality`". To upload this dataset, we need to make sure that the package datasets is selected under packages tab. You can find this package under *System Library*. Also, make sure that you have `dplyr` package installed and loaded.

- Load "`airquality`" dataset and assign it to a variable named `my_df`

- Display the structure of `my_df` using `str()` function and print the first six lines from `my_df`.

- Find the name of each column of `my_df` using `names()` function

- Create a new dataframe that shows only the temperature column and name it as `my_df_temp`. You can use `select()` function

- Find the mean, median, and standard deviation of the daily temperature in June, July, and August

Assume that the temperatures in the months from <u>May to September</u> are normally distributed, i.e., follow the normal distribution. Find the following probabilities using pnorm() function:

- The probability that the temperature during these months is less than 70.

- The probability that the temperature during these months is greater than 85

- The probability that the temperature during these months is less than 90 and greater than 75

Confirm your answers manually using the z-tables shown in the class.

<u>Show your ansdwers to the lab professor</u>