University of Colombo, Sri Lanka

UCSC *University of Colombo School of Computing*

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Second Year Examination - Semester II – UCSC AY19 [held in March/ April/May 2023]

SCS2211 - Laboratory II

Two (2) Hours

~~021~~

151

Number of Pages = 12 Number of Questions = 4

To be completed by the candidate

Index Number: | | | | | | | | |

Important Instructions to candidates:

I. Students should answer in the medium of **English language only** using the space provided in this question paper.

II. Note that questions appear on both sides of the paper. If a page or a part of this question paper is not printed, please inform the supervisor immediately.

III. Write your index number **CLEARLY** on each and every page of this Question paper.

IV. This paper consists of **4** questions on **12** pages (including the Cover Page).

V. Answer **ALL** questions. All questions carry equal (25) marks..

VI. Any electronic device capable of storing and retrieving text including electronic dictionaries, smart watches and mobile phones are **not allowed**.

VII. **Non-Programmable** calculators are **allowed.**

VIII. Do not tear off any part of this answer book. Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.

To be completed by the examiners

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Question 1

(a) Write the outputs of the octave code fragments given below.

i.
```
>> myVariable = [2:4;3:5;linspace(-2,2,3)]
>> size(myVariable)
```

[03 Marks]

ii.
```
>> a= 1:15;
>> a = reshape(a, 3, 5)
>> a(2:3,3)=[99 ; 99]
>> a
```

[04 Marks]

iii.
```
ceil(5.7)
```

[02 Marks]

iv.
```
>> a = "My name is su";
>> b = "I love Octave";
>> c = "I like Maths and Stat";
>> d = "I am studying at UCSC";
>> e = "."; f = " ";
>>[a e f c e ; d e f b e]
```

[04 Marks]

```
v. A = [3.7, 2.4, 0.3, 5.2, 4.8]
   find( A > 3.5)
```

[02 Marks]

(b) A two-dimensional object on an Octave plot (see Figure 1) can be subjected to a scaled up (or down) linear transformation. To scale an object by a factor of k the matrix **Tz** = $\begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix}$ can be used. Complete the code in the code listing which is designed to dilate the given triangle by **factor of 2**.

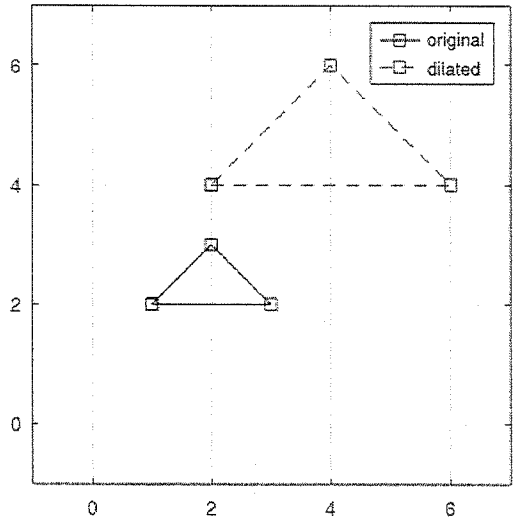

Figure 1: Dilation of a Triangle

Code Listing 1: Scale Operation

[10 Marks]

`T1 = [1,3,2,1;2,2,3,2];  %points in first triangle`
`Tz = [_____,0;_____,_____];  % Transformation matrix`
`T2 = _____  % Transformation of the triangle`
`x1 = T2(_____ ,:); x = T1(1,:); % Find the vectors`
`y1 = T2(2,:); y=T1(_____,:);  % Find the vectors`
`plot(x ,_____ , 'sb-', _____ , _____ , 'sr--')` `%plot triangle`
`_____ ;  % grid on`
`_____ ( 'original' , 'dilated' )  % legend`

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Question 2.

(a) Write your answers to the each of the following:

i. What is the output of `stringConcat = ["foo";'bar',"huz"]`

[01 Mark]

ii. What is the text printed if the following code snippet is executed?

```
for n=1:3
  for m=1:2:5
    printf("%d %d", n, m);
      if ( m==2 )
        break;
      endif
  endfor
endfor
```

[04 Marks]

iii. What would be the value of the Z after executing the code below?

```
x = linspace(-2,2,5)
y = linspace(-2,2,5)
[X,Y] = meshgrid(x,y)
Z = X+Y
```

[03 Marks]

iv. Write down the Octave content for the three blanks to convert the variable quote to the commented.

[02 Marks]

```
quote = "the quick brown fox jump over the lazy dog"
% the quick br8wn f8x jump 8ver the lazy d8g

_________ (quote _________"o")  _________ '8'
```

(b) Create two **Octave struct** type variables named **employer1** and **employer2**. **employer1** has **name** as "Luke" and **employee id** as 1285 (number) while **employer2** has name as "Mary" and **dob** as "89-05-23"(String).

[04 Marks]

(c) The given Code Listing 2 generates a plot for random noisy data by fitting a second-order polynomial that best fits the data. Fill the indicated blanks in the code.

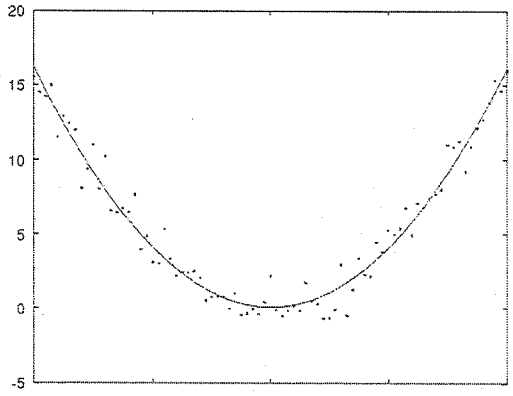

Figure 2:polynomial fitting. Noisy data

Code Listing 2 : Polynomial plotting [05 Marks]

```
x = -4:0.1:4;
Y = x.^2;
y = y + _____(size(y)); % plot random noisy signals
plot(x,y,'.') %
P = _____(x,y,____);%fit 2nd degree polynomial to the data
hold on;
plot(x,_____(p,x),'r') % plot the fitted polynomial
```

(d) Write the Octave commands that can be used to solve the system of linear equations given below.

```
x+2y = 9
4x + 3y = 11
```

[02 Marks]

(e) Solve the following system of equations by finding the **Reduced Row Echelon Form** (RREF) of the augmented matrix associated with the given system. Give the original augmented matrix, the reduced row echelon form of the matrix and the solution to the system of equations. Show the steps clearly.

```
-1x + 5y = 4
5x + 2y = 7
```

[04 Marks]

Question 3

(a) Suppose you are conducting a study on the relationship between a student's chosen major and the grade point average (GPA).

i. What type of scale of measurement would you use to measure the GPA of students?

[02 Marks]

ii. Specify whether the data you collect is discrete or continuous.

[02 Marks]

iii. If you wanted to group students into categories based on their majors (e.g., Biology, Engineering, History), what scale of measurement would you use for the data in each category?

[02 Marks]

(b) Fifteen students' performance in a 100m freestyle swimming competition is listed below, indicating the time in seconds that each student took to complete the race.

52, 54, 54, 55, 58, 58, 59, 60, 60, 61, 61, 64, 67, 70, 75

i. Arrange the above data in a *stem and leaf diagram*.

[02 Marks]

ii. Write the **R** code to create the vector named **time** and to draw the stem and leaf diagram.

[02 Marks]

iii. Compute the Mean.

[02 Marks]

iv. Compute the Median.

[02 Marks]

v. State 03 numerical methods of measuring the variability/dispersion of the given data.

[03 Marks]

vi. Compute the 25^{th} and 75^{th} percentiles.

[04 Marks]

vii. Using the appropriate measures calculated in part (b) draw a sketch of the boxplot.
[04 Marks]

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Question 4.

(a) Suppose a car manufacturer wants to estimate the average fuel efficiency of a new model it is planning to release. From previous tests it is known that the population variance of fuel efficiency is 16. The manufacturer takes a random sample of 36 cars from the production line and measures their fuel efficiency. The sample mean fuel efficiency is 30 miles per gallon.

i. What is the point estimate of the population mean fuel efficiency based on the sample data?

[01 Mark]

ii. What is the 95% confidence interval estimate of the population mean fuel efficiency based on the sample data? (The z-value for a **95%** confidence level with a two-tailed test is **Z = 1.96)**

[05 Marks]

iii. What is the minimum sample size needed to estimate the population mean fuel efficiency with a 95% confidence level and a margin of error no more than 2 miles per gallon?

[02 Marks]

(b) Researchers are considering a new drug for the treatment of migraine headaches, but some individuals who participated in early tests of the medication have reported experiencing slight nausea as a side effect. The FDA (Food and Drug Administration) will reject the drug if it thinks that more than 15% of the population would suffer from this side effect. In an experiment to test this side effect, 400 people who suffer from migraine headaches receive the new drug and 80 of them report nausea as a side effect.

i. Define the parameter of interest, giving appropriate notation and writing a sentence saying what it is.

[01 Mark]

ii. State the null and alternative hypothesis. (Use notation, not words.)

[04 Marks]

The following R code is used for the analysis.

```
> pbar = 80/400
> p0 = .15
> n = 400
> z = (pbar-p0)/sqrt(p0*(1-p0)/n)
> z
[1] 2.80056
> pval = pnorm(z ,lower.tail=FALSE)
> pval
[1] 0.0025507
```

iii. What is the value of the test static?

[01 Mark]

iv. At 5% significance level, give your decision and the conclusion clearly.

[03 Marks]

(c) Write the outputs of the following code segments.

```
i. class(4L)
```

[02 Marks]

```
ii.  matrix(month.name, nrow=3)
```

[02 Marks]

```
iii. > v <- c("one","Two","Three","Four","Five")
     > v[c(1:2,4)]
```

[02 Marks]

```
iv.  seq(1,20,5)
```

[02 Marks]

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