

ADICHUNCHANAGIRI UNIVERSITY

B G S INSTITUTE OF TECHNOLOGY

B G Nagar – 571448.



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING LAB MANUAL

Academic Year : 2019–2020 (ODD SEMESTER)
Programme (UG/PG) : UG
Year / Semester : 2nd Year / 3rd Semester
Course Code : 18CSL38
Course Title : DMS LABORATORY

Prepared By:

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B G S INSTITUTE OF TECHNOLOGY

VISION

BGSIT is committed to the cause of creating tomorrow's engineers by providing quality education inculcating ethical values.

MISSION

M1: Imparting quality technical education by nurturing a conducive learning environment.

M2: Offering professional training to meet industry requirements.

M3: Providing education with a moral-cultural base and spiritual touch.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To produce engineers by possessing good technical knowledge and ethics through quality education and research.

MISSION

M1: Achieve excellence by providing good infrastructure and competent faculty.

M2: Strengthening the technical, soft skills, leadership qualities and ethical values to meet the industry requirements.

M3: Facilitate experimental learning through research projects.

INSTRUCTIONS TO STUDENTS

Computer Lab Safety Rules for Protecting Equipment

- Turn off the machine once you are done using it.
- Do not plug in external devices without scanning them for computer viruses.
- Try not to touch any of the circuit boards and power sockets when a device is connected to them and switched on.
- Always maintain an extra copy of all your important data files.

General Safety Guidelines to be followed at all times

- All users of the laboratory are to follow the directions of Academic/Laboratory Technician staff member.
- Students should not attempt to repair, open, tamper or interfere with any of the computer, printing, cabling, air conditioning or other equipment in the laboratory.
- Students should be aware of office ergonomic guidelines for correct posture when using computer equipment.
- Please treat fellow users of the laboratory, and all equipment within the laboratory, with the appropriate level of care and respect.

DO's AND DON'Ts

Do's

- Enter the log register
- Follow the dress code and wear ID card
- Always keep quiet. Be considerate to other lab users.
- Report any problems with the computer to the person in charge.
- Shut down the computer properly and keep the chairs aligned before leaving the lab.
- Know the location of the fire extinguisher and the first aid box and how to use them in case of an emergency.
- Report any broken plugs or exposed electrical wires to your lecturer/laboratory technician immediately.

Don'ts

- Do not eat or drink in the laboratory.
- Do not use mobile phone.
- Don't damage, remove, or disconnect any labels, parts, cables or equipment.
- Avoid stepping on electrical wires or any other computer cables.
- Do not install or download any software or modify or delete any system files on any lab computers.
- If you leave the lab, do not leave your personal belongings unattended.
- Do not open the system unit casing or monitor casing particularly when the power is turned on.
- Do not insert metal objects such as clips, pins and needles into the computer casings. They may cause fire.

LABORATORY RUBRICS

FOR 40 MARKS (2018 CBCS SCHEME)

Sl. No.	Description	Marks
1	<u>Continuous Evaluation</u>	<u>30</u>
	a. Observation write up and punctuality	5.0
	b. Conduction of experiment and output	10.0
	c. Viva voice	5.0
	d. Record write up	10.0
2	<u>Internal Test</u>	<u>10</u>

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the

knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Ability to apply Mathematical Methodologies, Management Principles and Ethics, Electronics and Embedded Systems and Programming Technologies to solve real time problems.

PSO 2: Ability to apply software design and development practices to develop software in emerging areas such as Internet of Things, Data Management, Social Networking and Security, Cloud and High Performance Computing.

COURSE OUTCOMES

Upon successful completion of this course, students should be able to:

CO1	Analyze the critical thinking of mathematics.
CO2	Apply the principles and properties of counting and integers.
CO3	Understand the principles and properties of relations, functions, inclusion and exclusion.
CO4	Apply the principles and properties of trees and graphs.
CO5	Understand the usage of MiniTab to solve the problems and plot the graph.

CO-PO-PSO MAPPING

CO/PO'S	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	
AVG	3	3	2.8	2	2								3	

DISCRETE MATHEMATICAL STRUCTURES LABORATORY			
Adichunchanagiri University			
(Effective from the Academic Year 2019 -20)			
SEMESTER – III			
Subject Code	18CSL38	CIE Marks	40
Number of Contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab Contact Hours	36	Exam Hours	3 Hrs
CREDITS – 2			
Course Learning Objectives: This course will enable students to:			
This laboratory course enable students to get practical experience in design, develop, implement, analyze and evaluation/testing of			
<ul style="list-style-type: none">• Critical thinking of mathematics.• Principles of counting and properties of integers• Properties of relations, functions, Principles of inclusion and exclusion.• Properties of graphs and trees• Understand the usage of Minitab to solve the problems and plot the graph.			
Descriptions (if any):			
Implement Part – A programs in C Programming Language and Linux / Windows as OS.			
Implement Part – B programs using Minitab			
Programs List:			
PART – A			
1.	Write a program to prove the D’Morgan’s Laws.		
2.	Write a program to generate Lucas numbers ($L_n = L_{n-1} + L_{n-2}$; $L_0 = 2$, $L_1 = 1$, $L_n = 2, 1, 3, 4, 7, 11, 18, 29, 47, 76, \dots$).		
3.	6 Boys and 4 Girls got elected as class representatives in a college. A five member student council has to be formed from the elected class representatives. Write a program in how many ways this council can be formed such that i) There are 3 boys and 2 girls ii) At least 2 girls. iii) At least 3 boys.		
4.	Program for the application of Principle of inclusion and exclusion. $ A \cup B \cup C = A + B + C - A \cap B - B \cap C - A \cap C + A \cap B \cap C $		
5.	Write a program to find all the permutations of a given string.		
PART – B			
1.	Use MINITAB to construct a histogram, dot plot, stem-and-leaf plot, and box plot of the following data: {810, 765, 860, 825, 795, 785, 810, 790, 785, 815, 800, 790}		
2.	For the following data sets: i) {43; 46; 54; 51; 45; 49; 42; 52; 50} ii) {810, 765, 860, 825, 795, 785, 810, 790, 785, 815, 800, 790}		

	<p>use pencil and paper or a calculator to find:</p> <p>(a) the median</p> <p>(b) the mean</p> <p>(c) the range</p> <p>(d) the standard deviation</p> <p>Use MINITAB to check your answers.</p>
3.	<p>Create the data for the three shipping canters like Central, Eastern and Western respectively and determine whether the shipping data follow a normal distribution or not and plot the paneled histogram of the time lapse between order data and delivery date.</p> <p>The columns contain the following information:</p> <ul style="list-style-type: none"> • Center: shipping center name • Order: order date and time • Arrival: delivery date and time • Days: delivery time in days • Status: delivery status <ul style="list-style-type: none"> ✓ On time indicates that the book shipment was received on time. ✓ Back order indicates that the book cannot be shipped yet because it is not currently in stock. ✓ Late indicates that the book shipment was received six or more days after the order was placed. • Distance: distance from the shipping center to the delivery location
4.	<p>Create the scatter plot (groups) of days versus distance by shipping center for the problem 3. Analyse and interpret the results by providing different reports like summary report, diagnostic report, descriptive statistics report and report card.</p>
5.	<p>Determine how many book orders were delivered on time, how many were late, and how many were initially back ordered for each shipping center.</p>
Laboratory Outcomes: The student should be able to:	
<ul style="list-style-type: none"> • Analyze the critical thinking of mathematics. • Apply the principles and properties of counting and integers. • Understand the principles and properties of relations, functions, inclusion and exclusion. • Apply the principles and properties of trees and graphs. • Understand the usage of MiniTab to solve the problems and plot the graph. 	
Conduct of Practical Examination:	
<ul style="list-style-type: none"> • Experiment distribution 	
<ul style="list-style-type: none"> • Students are allowed to pick one experiment from part A and one experiment from part B and are given equal opportunity. • Change of experiment is allowed only once and marks allotted for procedure part to be made zero. • Marks Distribution (<i>Subjected to change in accordance with university regulations</i>) <ol style="list-style-type: none"> 1. Part A - Procedure + Execution + Viva = 10 + 35 + 5 = 50 Marks 2. Part B - Procedure + Execution + Viva = 10 + 35 + 5 = 50 Marks 	

TABLE OF CONTENTS**PART-A**

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PART-B

Program No.	Program Title	Page No.
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PART-A (C-PROGRAMS)**1. Write a program to prove the D'Morgan's Laws.**

```
#include <stdio.h>
#include <math.h>

int main()
{
    int a;
    int b;
    int g;
    int i;
    int j;
    int x;
    int y;
    char ch = 'y';

    do
    {
        puts("\nShow that  $!(x < 5) \&\& !(y \geq 7)$  and  $!(x < 5) \parallel (y \geq 7)$  are logically equivalent\n\n");

        printf("%s", "Enter x: ");
        scanf("%2u", &x);
        printf("%s", "Enter y: ");
        scanf("%2u", &y);

        if ( $!(x < 5) \&\& !(y \geq 7) \&\& !(x < 5) \parallel (y \geq 7)$ ) {
            printf("%s", "True!\n\n");
        }
        else {
            printf("%s", "False!\n\n");
        }

        printf("%s", "Want more examples of this logical equivalency? ");
        getchar();
        scanf("%c", &ch);

    } while (ch == 'y');

    if (ch == 'n') {

        do {
            puts("\nShow that  $!(a == b) \parallel !(g != 5)$  and  $!(a == b) \&\& (g != 5)$  are logically equivalent\n\n");
```

```
printf("%s", "Enter a: ");
scanf("%2u", &a);
printf("%s", "Enter b: ");
scanf("%2u", &b);
printf("%s", "Enter g: ");
scanf("%2u", &g);

if (((a == b) || !(g != 5)) && !((a == b) && (g != 5))) {
    printf("%s", "True!\n\n");
}
else {
    printf("%s", "False!\n\n");
}
printf("%s", "Want more examples of this logical equivalency? ");
getchar();
scanf("%c", &ch);

} while(ch == 'y');
}

if (ch == 'n') {

    do {
        puts("\nShow that  $!((x \leq 8) \&\& (y > 4))$  and  $!(x \leq 8) \parallel !(y > 4)$  are
logically equivalent\n\n");

        printf("%s", "Enter x: ");
        scanf("%2u", &x);
        printf("%s", "Enter y: ");
        scanf("%2u", &y);

        if (!((x <= 8) && (y > 4)) && !(x <= 8) || !(y > 4)) {
            printf("%s", "True!\n\n");
        }
        else {
            printf("%s", "False!\n\n");
        }
        printf("%s", "Want more examples of this logical equivalency? ");
        getchar();
        scanf("%c", &ch);
    } while (ch == 'y');
}
```

```
if (ch == 'n') {  
  
    do {  
        puts("\nShow that  $!(i > 4) \parallel (j \leq 6)$  and  $!(i > 4) \&\& !(j \leq 6)$  are logically  
equivalent\n\n");  
  
        printf("%s", "Enter i: ");  
        scanf("%2u", &i);  
        printf("%s", "Enter j: ");  
        scanf("%2u", &j);  
  
        // if statement to handle logical equivalency  
        if ( $!(i > 4) \parallel (j \leq 6) \&\& !(x \leq 8) \&\& !(y > 4)$ ) {  
            printf("%s", "True!\n\n");  
        }  
        else {  
            printf("%s", "False!\n\n");  
        }  
        printf("%s", "Continue? ");  
        getchar();  
        scanf("%c", &ch);  
    } while (ch == 'y');  
}  
  
if (ch == 'n') {  
    printf("\n%s", "DeMorgan's Laws Proven");  
}  
  
// system("pause");  
return 0;  
}
```

OUTPUT:

Show that $!(x < 5) \&\& !(y \geq 7)$ and $!(x < 5) \parallel (y \geq 7)$ are logically equivalent

Enter x: 1

Enter y: 2

False!

Want more examples of this logical equivalency? y

Show that $!(x < 5) \&\& !(y \geq 7)$ and $!(x < 5) \parallel (y \geq 7)$ are logically equivalent

Enter x: 9

Enter y: 2

True!

Want more examples of this logical equivalency? n

Show that $(!(a == b) \parallel !(g != 5))$ and $!((a == b) \&\& (g != 5))$ are logically equivalent

Enter a: 2

Enter b: 1

Enter g: 4

True!

Want more examples of this logical equivalency? y

Show that $(!(a == b) \parallel !(g != 5))$ and $!((a == b) \&\& (g != 5))$ are logically equivalent

Enter a: 1

Enter b: 1

Enter g: 1

False!

Want more examples of this logical equivalency? n

Show that $!(x \leq 8) \&\& (y > 4)$ and $!(x \leq 8) \parallel !(y > 4)$ are logically equivalent

Enter x: 2

Enter y: 1

True!

Want more examples of this logical equivalency? y

Show that $!(x \leq 8) \&\& (y > 4)$ and $!(x \leq 8) \parallel !(y > 4)$ are logically equivalent

Enter x: 1

Enter y: 9

False!

Want more examples of this logical equivalency? n

Show that $!(i > 4) \parallel (j \leq 6)$ and $!(i > 4) \&\& !(j \leq 6)$ are logically equivalent

Enter i: 1

Enter j: 4

False!

DeMorgan's Laws Proven

2. Write a program to generate Lucas numbers ($L_n = L_{n-1} + L_{n-2}$; $L_0 = 2, L_1 = 1$, $L_n = 2, 1, 3, 4, 7, 11, 18, 29, 47, 76, \dots$).

```
#include<stdio.h>
int main()
{
    int n,L0=2,L1=1,Ln;
    printf("Enter the values of n:\n");
    scanf("%d",&n);
    if(n==0)
        printf("%d\n",L0);
    else if(n>0)
        printf("%d,%d",L0,L1);
    for(int i=2;i<n+1;i++){
        Ln = L0 + L1;
        L0 = L1;
        L1 = Ln;
        printf("%d,", Ln);
    }
    return 0;
}
```

OUTPUT:

```
Enter the values of n:
8
2,1,3,4,7,11,18,29,47
```

3. **6 Boys and 4 Girls** got elected as class representatives in a college. A five member student council has to be formed from the elected class representatives.
Write a program in how many ways this council can be formed such that
i) There are 3 boys and 2 girls ii) At least 2 girls. iii) At least 3 boys.

```
#include<stdio.h>

int fact(int num)
{
    if(num==0)
    {
        return 1;
    }
    else if(num==1)
    {
        return 1;
    }
    else
    {
        return num * fact(num-1);
    }
}

int f (int r1, int r2, int b, int g)
{
    int temp1 = 0, temp2 = 0, X = 0;

    temp1=(fact(b)/fact(b-r1))/fact(r1);

    temp2=(fact(g)/fact(g-r2))/fact(r2);

    X = temp1 * temp2;

    return X;
}

int main()
{
    int boys, girls;
    int A, B, C;

    boys = 6;
    printf("Number of Boys:%d", boys);
    girls = 4;
    printf("Number of Girls:%d", girls);
}
```

```
// 3 Boys and 2 Girls
A = f(3, 2, boys, girls);
printf("3 boys and 2 girls:%d", A);

// Atleast 2 Girls
B = f(3, 2, boys, girls) + f(2, 3, boys, girls) + f(1, 4, boys, girls);
printf("Atleast 2 girls:%d", B);

// Atleast 3 Boys
C = f(3, 2, boys, girls) + f(4, 1, boys, girls) + f(5, 0, boys, girls);
printf("Atleast 3 boys:%d", C);
return 0;
}
```

OUTPUT:

Number of Boys:**6**
Number of Girls:**4**
3 boys and 2 girls:**120**
Atleast 2 girls:**186**
Atleast 3 boys:**186**

4. Program for the application of Principle of inclusion and exclusion. $|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |B \cap C| - |A \cap C| + |A \cap B \cap C|$

```
#include <stdio.h>
int count(int a[], int m, int n)
{
    int odd = 0, even = 0;
    int counter, i, j, p = 1;
    int pow_set_size = (1 << n);
    for (counter = 1; counter < pow_set_size; counter++)
    {
        p = 1;
        for (j = 0; j < n; j++)
        {
            if (counter & (1 << j))
            {
                p *= a[j];
            }
        }
        if (__builtin_popcount(counter) & 1) {
            odd += ( m / p );
        }
        else
            even += ( m / p );
    }

    return odd - even;
}

int main()
{
    int a[] = { 2, 3, 5 };
    int m = 100;
    int n = 3;
    printf("%d\n", count(a, m, n));
    return 0;
}
```

OUTPUT:

The total numbers divisible by given prime integers: **74**

5. Write a program to find all the permutations of a given string.

```
#include<stdio.h>
#include<string.h>
void swap(char *a, char *b)
{
    char temp;
    temp= *a;
    *a=*b;
    *b=temp;
}

void permutation(char *a, int l, int r)
{
    int i;
    if(l==r)
        printf("%s\n",a);
    else
        for(i=l;i<=r;i++)
        {
            swap((a+l),(a+i));
            permutation(a,l+1,r);
            swap((a+l),(a+i));
        }
}

int main()
{
    char str[]="ABC";
    int n=strlen(str);
    printf("\n the permutations of the given string\n");
    permutation(str,0,n-1);
    return 0;
}
```

OUTPUT:

```
The permutations of the given string
CSE
CES
SCE
SEC
ESC
ECS
```

PART-B (MINITAB)

Minitab19 for Windows introduces you to some of the most commonly used features and tasks in Minitab, such as:

- Explore data with graphs and present results
- Conduct statistical analyses
- Assess quality
- Design an experiment
- Use shortcuts to automate future analyses Import data into Minitab from different file types and prepare the data for analysis

The Minitab interface includes the following components:

1: Navigator

Contains the list of output titles in your project sorted from oldest to newest, with the most recent output titles at the bottom of the list. Right-click any output title in the Navigator to do the following tasks:

- Open the output in split view to compare it to the output on a different tab.
- Rename the output. When you rename the output, the name updates in the output pane.
- Send the output to a different application, such as Word, PowerPoint, or Companion by Minitab.
- Delete the analysis from the project. You can undo this action from the Edit menu.
-

2: Output pane

Displays output, such as graphs and tables, after you run an analysis. Output for each analysis is displayed on a single tab. From the output pane, you can do the following tasks:

- To affect the contents of a tab, click the tab, then click next to the output title.
- To affect a specific table or graph, click the graph or the table, then click.
- To view output that is not currently visible, click the title of the output in the Navigator.

3: Data pane (worksheets)

Displays the active worksheet. You can have multiple worksheets open in the data pane at the same time; however, Minitab uses the data in the active worksheet to run the analysis.

Program 1. Use MINITAB to construct a histogram, dot plot, stem-and-leaf plot, and box plot of the following data: {810, 765, 860, 825, 795, 785, 810, 790, 785, 815, 800, and 790}

SOLUTION:

Step 1: **Type your data into columns** in Minitab. In most histogram cases, you'll have two sets of variables in two columns.

Step 2: **Click “Graph”** and then click “Histogram.”

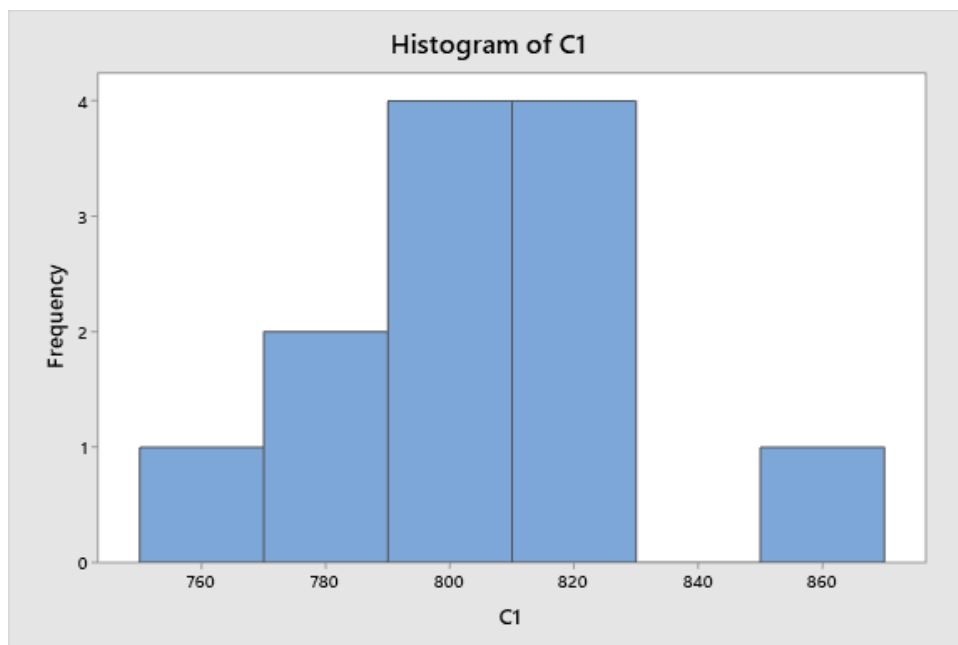
Step 3: **Choose the type of histogram** you want to make. In most cases for elementary statistics, a “Simple” histogram is usually the best option.

Step 4: **Click “OK.”**

Step 5: **Choose the name of the variable** you want to make a histogram for and then click the “Select” button to move that variable name to the Graph Variables box.

Step 6: **Click “OK”** to create the histogram in Minitab.

Output:



- Same way create different graphs (dot plot, stem-and-leaf plot, box plot).

Interpretation of results:

- These graphs provides the information about frequency (appearance) of the values with in certain range. Eg: you can observe in the graph there are 4 values between the ranges 800 to 820. Hence it shows the frequency as 4.

Program 2. For the following data sets:

- {43; 46; 54; 51; 45; 49; 42; 52; 50}
- {810, 765, 860, 825, 795, 785, 810, 790, 785, 815, 800, 790}

Use pencil and paper or a calculator to find:

- The median
- The mean
- The range
- The standard deviation

Use MINITAB to check your answers.

SOLUTION:

Manual Solution:

Consider the dataset,

{43; 46; 54; 51; 45; 49; 42; 52; 50}

There are $N = 9$ numbers within our data set. The data set is our complete set of values so we call it our population. We say that we are using descriptive statistics because we have the values of the entire population within our calculations.

Mean: The mean, μ , is the result when all of the values are added together and then divided by the number of values within the data set, N .

$$\mu = (43+46+54+51+45+49+42+52+50)/9 = 48$$

Median: The midpoint in a string of sorted data. If we sort our data in ascending order we get: 42;43;45;46; 49;50;51;52;54

49 is the median as it is at the midpoint of the ordered data. If there is an even number of elements within the data set then the mean of the middle two numbers is taken to be the median.

Range: Range is the difference between the largest and the smallest of the elements within the data set.

Data Set = 42;43;45;46; 49;50;51;52;54

$$\text{Range} = \text{Max Value} - \text{Min Value} = 54-42 = 12$$

Standard Deviation:

The Sum of Deviations Squared may also be called the sum of squares. Note that we are using the sum of squares procedure on the deviations.

$$\text{Variance} = \sigma^2 = \frac{\sum_{i=1}^N (x_i - \mu)^2}{N}$$

$$\text{StDev.P} = \sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \mu)^2}{N}}$$

Remember these are equations for population parameters. StDev.P stands for population standard deviation.

The table below shows how the StDev.P for our data set is derived manually.

Dataset	Mean	Deviation	Deviation sqr	Sum of sqrs of Deviation	Variance	Std, Deviation
43	48	-5	25	140	15.55556	3.94
46		-2	4			
54		6	36			
51		3	9			
45		-3	9			
49		1	1			
42		-6	36			
52		4	16			
50		2	4			

Solution: Using Minitab.

Step 1: **Type your data into columns** in a Minitab worksheet. The worksheet functions the same way as an Excel worksheet — the optimal place for your data is in a column format.

Step 2: **Click “Stat”, then click “Basic Statistics,” then click “Descriptive Statistics.”**

Step 3: **Click the variables you want to find the mean for** and then click “Select” to move the variable names to the right window.

Step 4: **Click “Statistics.”**

Step 5: **Check the Mean, Median, Range, Standard deviation Check boxes and then click “OK” twice.** The results will be displayed in a new window.

Step 6: Verify the manual values with the Minitab output.

MiniTab Output:

Variable	Mean	StDev	Minimum	Median	Maximum	Range
C1	48.00	4.18	42.00	49.00	54.00	12.00

Interpretation of results:

Compare the manual solution with the MiniTab solution, to verify the values, where both should be match.

Program 3. Create the data for the three shipping centers like Central, Eastern and Western respectively and determine whether the shipping data follow a normal distribution or not and plot the paneled histogram of the time lapse between order date and delivery date.

The columns contain the following information:

- Center: shipping center name
- Order: order date and time
- Arrival: delivery date and time
- Days: delivery time in days
- Status: delivery status
 - ✓ On time indicates that the book shipment was received on time.
 - ✓ Back order indicates that the book cannot be shipped yet because it is not currently in stock.
 - ✓ Late indicates that the book shipment was received six or more days after the order was placed.
- Distance: distance from the shipping center to the delivery location.

SOLUTION:

Step 1: Open the sample dataset ShippingData.MTW. (Double click on the data file, it directly opens the MiniTab window).

Step 2: Choose **Graph > Histogram**.

Step 3: Choose **With Fit**, and then click **OK**.

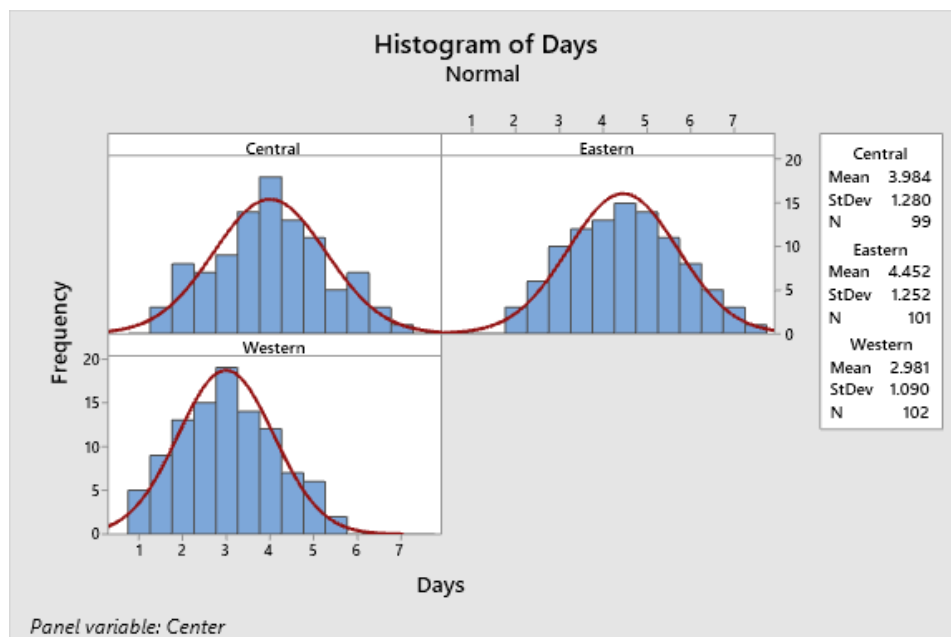
Step 4: In **Graph variables**, enter *Days*.

Step 5: Click **Multiple Graphs**, and then click the **By Variables** tab.

Step 6: In **By variables with groups in separate panels**, enter *Center*.

Step 7: Click **OK** in each dialog box.

Output:



Interpretation of results:

The histograms seem to be approximately bell- shaped and symmetric about the means, which indicates that the delivery times for each center are approximately normally distributed.

Program 4: Create the scatter plot (groups) of days versus distance by shipping center for, problem 3. Analyze and interpret the results by providing different reports like summary report, diagnostic report, descriptive statistics report and report card.

SOLUTION:**Explanation:****Create a scatterplot with groups**

To examine the relationship between two variables, you use a scatterplot. You can choose a scatterplot from the Graph menu or you can use the Minitab Assistant. The Assistant can be used for most basic statistical tests, graphs, quality analyses, and DOE (design of experiments).

Use the Assistant in the following situations:

- You need assistance to choose the correct tool for an analysis.
- You want dialog boxes that have less technical terminology and that are easier to complete.
- You want Minitab to check the analysis assumptions for you.
- You want output that is more graphical and explains in detail how to interpret your results.

Steps:

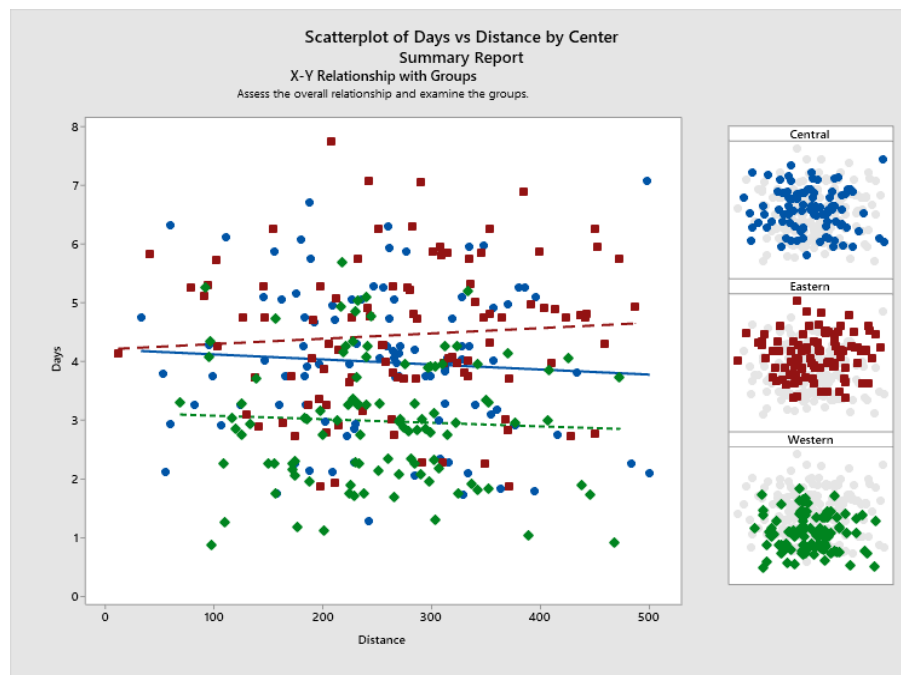
1. Choose **Assistant > Graphical Analysis**.
2. Under **Graph relationships between variables**, click **Scatterplot (groups)**.
3. In **Y column**, enter *Days*.
4. In **X column**, enter *Distance*.
5. In **Number of X columns**, choose **1**.
6. In **X1**, enter *Center*.

Output:**Interpret the results**

The Assistant provides standard reports to guide you through your analyses and help you interpret the results with confidence.

Summary report

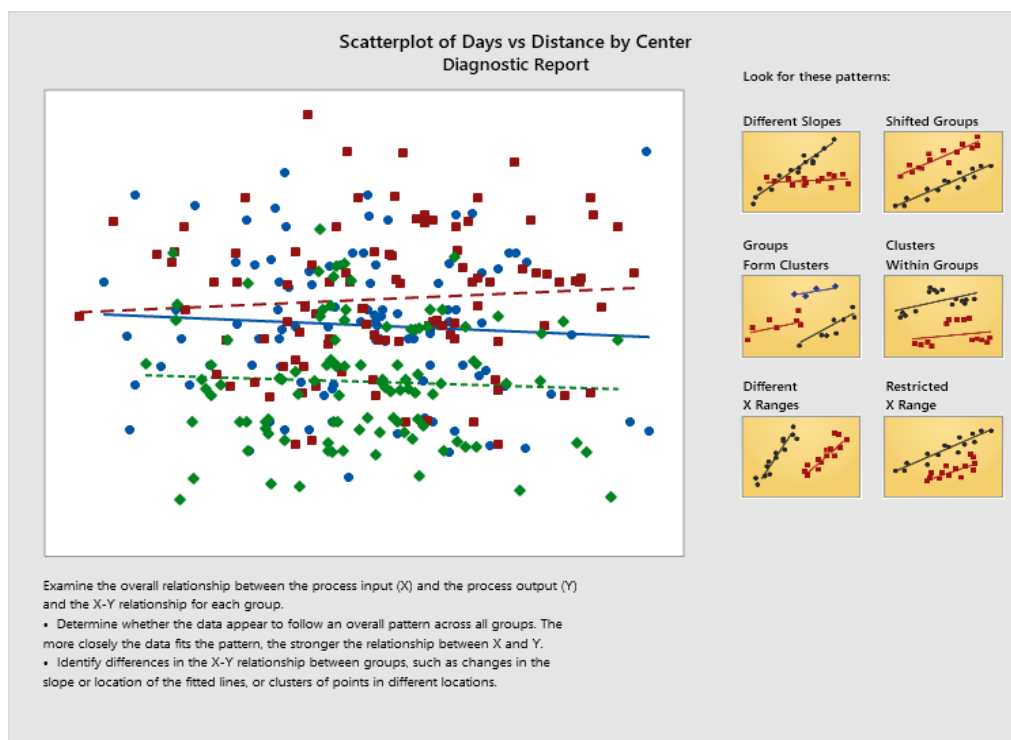
The summary report contains scatterplots of days versus distance by shipping center overlaid on the same graph. This report also provides smaller scatterplots for each shipping center.



Summary report

Diagnostic Report

The diagnostic report provides guidance on possible patterns in your data. The points on the scatterplot show no apparent relationship between days and distance. The fitted regression line for each center is relatively flat, which indicates that the proximity of a delivery location to a shipping center does not affect the delivery time.



Diagnostic Report

Descriptive statistics report

The descriptive statistics report contains descriptive statistics for each shipping center.

Center	N	Mean	Days			Mean	Distance		
			StDev	Minimum	Maximum		StDev	Minimum	Maximum
Central	99	3.9840	1.2798	1.2674	7.0701	253.64	99.797	32	500
Eastern	101	4.4520	1.2524	1.8597	7.7479	275.94	104.77	11	487
Western	102	2.9814	1.0896	0.87083	5.6806	251.63	88.492	68	473

Descriptive Statistics Report

Report card

The report card provides information on how to check for unusual data. The report card also indicates that there appears to be a relationship between the Y variable and the X variables. The Y variable is Days and the X variables are Distance and Center. Recall that the scatterplot indicated that there does not appear to be a relationship between days and distance.

Check	Status	Description
Unusual Data		<p>Check for unusual data points, which are points that do not appear to belong with the rest of the data. Unusual data can cause the fitted line to be pulled closer to the unusual points and away from other points. Because unusual data can strongly influence the results of any statistical analysis that you perform, you should try to identify the cause of their unusual nature.</p> <p>You can hover over a point or use Minitab's brushing feature to identify the worksheet rows that correspond to the outliers. Correct any data entry or measurement errors. Consider removing data that are associated with special causes and recreating the plot.</p>
Next Steps		<p>There appears to be a relationship between Y and the X variables. Consider performing a regression analysis to further explore the nature of the relationship.</p>

Report Card

Program 5: Determine how many book orders were delivered on time, how many were late, and how many were initially back ordered for each shipping center.

Display descriptive statistics:

1. Open the sample data, ShippingData.MTW.
2. Choose **Stat > Basic Statistics > Display Descriptive Statistics**.
3. In **Variables**, enter *Days*.
4. In **By variables (optional)**, enter *Center Status*.

For most Minitab commands, you need to complete only the main dialog box to execute the command. Often, you use sub-dialog boxes to modify the analysis or to display additional output, such as graphs.

5. Click **Statistics**.

6. Uncheck **First quartile**, **Median**, **Third quartile**, **N no missing**, and **N missing**.

7. Check **N total**.

8. Click **OK** in each dialog box.

Results for Center = Central

Statistics

Variable	Status	Total Count	Mean	SE Mean	StDev	Minimum	Maximum
Days	Back order	6	*	*	*	*	*
	Late	6	6.431	0.157	0.385	6.078	7.070
	On time	93	3.826	0.119	1.149	1.267	5.983

Results for Center = Eastern

Statistics

Variable	Status	Total Count	Mean	SE Mean	StDev	Minimum	Maximum
Days	Back order	8	*	*	*	*	*
	Late	9	6.678	0.180	0.541	6.254	7.748
	On time	92	4.234	0.112	1.077	1.860	5.953

Results for Center = Western

Statistics

Variable	Status	Total Count	Mean	SE Mean	StDev	Minimum	Maximum
Days	Back order	3	*	*	*	*	*
	On time	102	2.981	0.108	1.090	0.871	5.681

Interpret the results:

The output pane displays each center's results separately. Within each center, you can see the number of back-orders, late-orders, and on-time orders in the Total Count column:

- The Eastern shipping center has the most backorders (8) and late orders (9).
- The Central shipping center has the next most back orders (6) and late orders (6).
- The Western shipping center has the fewest back orders (3) and no late orders.

The output also includes the mean, standard error of the mean, standard deviation, minimum, and maximum of delivery time in days for each center. These statistics do not exist for back orders.