

Minitab 15 (English)

Minitab 15 : Introduction

Minitab

Is an Application Software for Studying Statistical Tools and applying them for Business needs.

It complements Six Sigma for its features and ease of implementation. Different customized tools and techniques used in Six Sigma are available in Minitab.

Minitab can also be used to plot different Graphs & Charts which are widely used during Six Sigma Project execution and different Business Processes.

Trial version of Minitab 15

- Free 30 Days Trial version of Minitab 15 can be downloaded from <http://minitab.com/products/minitab/demo/>
- Limited customer support can also be availed during the trial period.

Minitab 15 : Introduction

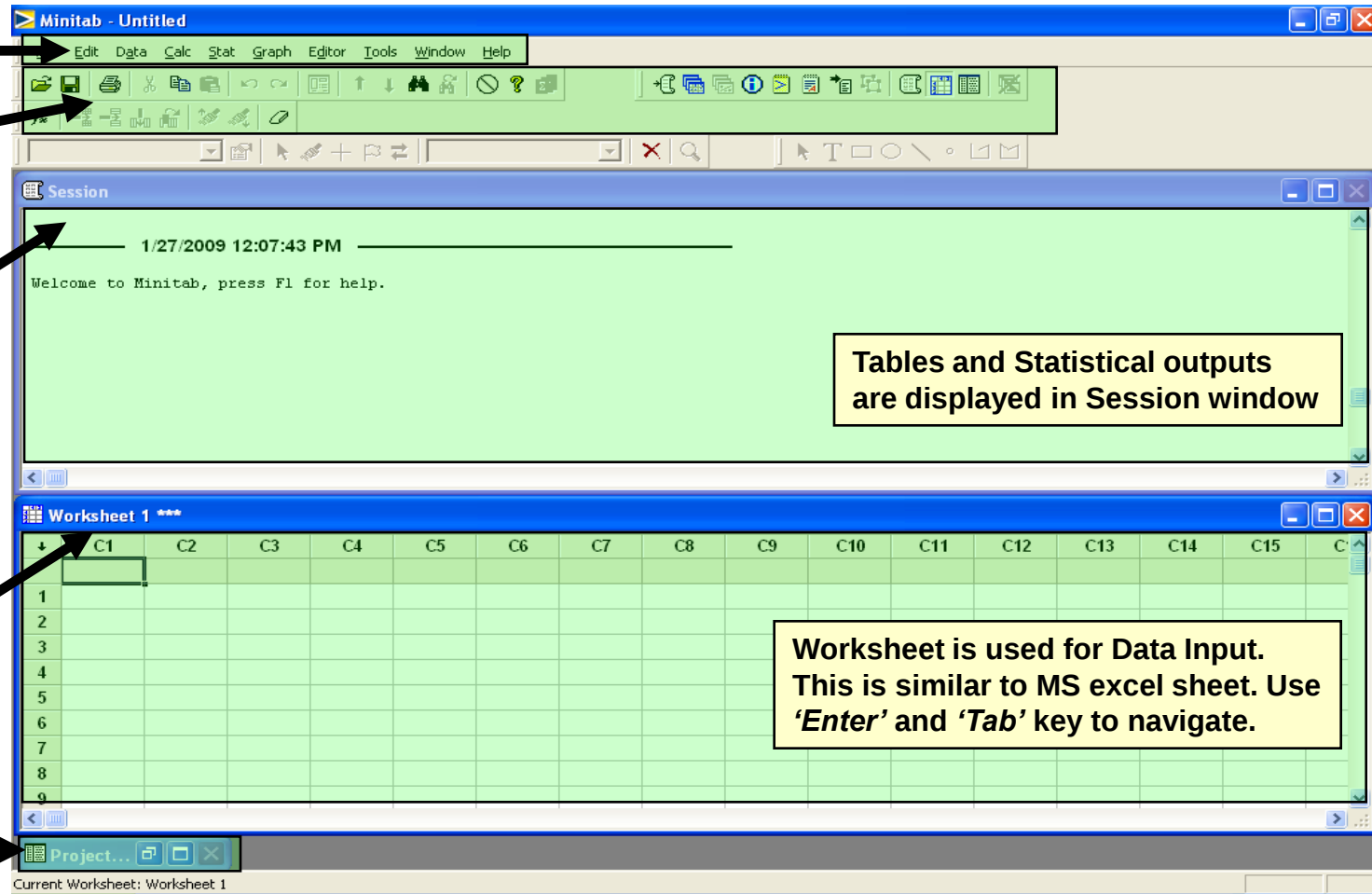
Menu Bar

Tool Bar

Session Window

Minitab Worksheet

Minitab Project



Opening and Saving Minitab File

- In Minitab, there are projects (Minitab Project, *.mpj) in which
- **Data** is stored in Minitab Worksheet, *.mtw
- **Graphs** are stored in Minitab Graphs, *.mgf
- Results in Minitab **Session**, *.txt

Minitab 15 : Introduction

Basic Tips

- Minitab uses different customized pre-defined functions to perform statistical tests for analysis, hence very sensitive to input data.
- Before applying any tool / performing any test different pre-requisites need to be verified to get reliable output.
- Minitab can recognize 3 Data types : Numeric, Text and Date. Data types are displayed at column indicators as **C1** (Numeric), **C1-T** (Text), **C1-D** (Date). While entering data consider the display of data type in column indicator to ensure there is no mismatch.
- Minitab worksheet is used for data input. Output is displayed in Session Window (Table and Text) and through Graphs.
- Minitab uses default values (e.g. Alpha=0.05 for Hypothesis Testing) for different tools and techniques. These parameters can be set at different levels as per the need and interpretation / inference should be made accordingly.

Minitab 15 : Basic

Topics

- Graphical Summary
- Normality Test
- Histogram
- Box Plot
- Dot Plot
- Pareto Chart
- Cause & Effect Diagram

Graphical Summary

The screenshot shows the Minitab software interface. The 'Stat' menu is open, and 'Graphical Summary...' is selected. The 'Graphical Summary' dialog box is open, showing the variable 'C1 Ticket Resolution' and the variable 'Ticket Resolution Time (Mins)' in the 'Variables' list. The 'Confidence level' is set to 95.0. The 'Select' button is highlighted.

Stat Menu Options:

- Basic Statistics
 - Display Descriptive Statistics...
 - Store Descriptive Statistics...
 - Graphical Summary...
- Regression
 - 12 1-Sample Z...
 - 1t 1-Sample t...
 - 2t 2-Sample t...
 - t-t Paired t...
- ANOVA
 - 1P 1 Proportion...
 - 2P 2 Proportions...
- DOE
 - 1s 1-Sample Poisson Rate...
 - 2s 2-Sample Poisson Rate...
- Control Charts
 - 1σ² 1 Variance...
 - 2σ² 2 Variances...
- Quality Tools
 - Correlation...
 - Covariance...
- Reliability/Survival
 - Normality Test...
- Multivariate
 - Goodness-of-Fit Test for Poisson...
- Time Series
- Tables
- Nonparametrics
- EDA
- Power and Sample Size

Graphical Summary Dialog Box:

Variables: 'Ticket Resolution Time (Mins)'

By variables (optional):

Confidence level: 95.0

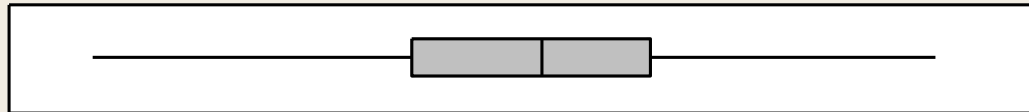
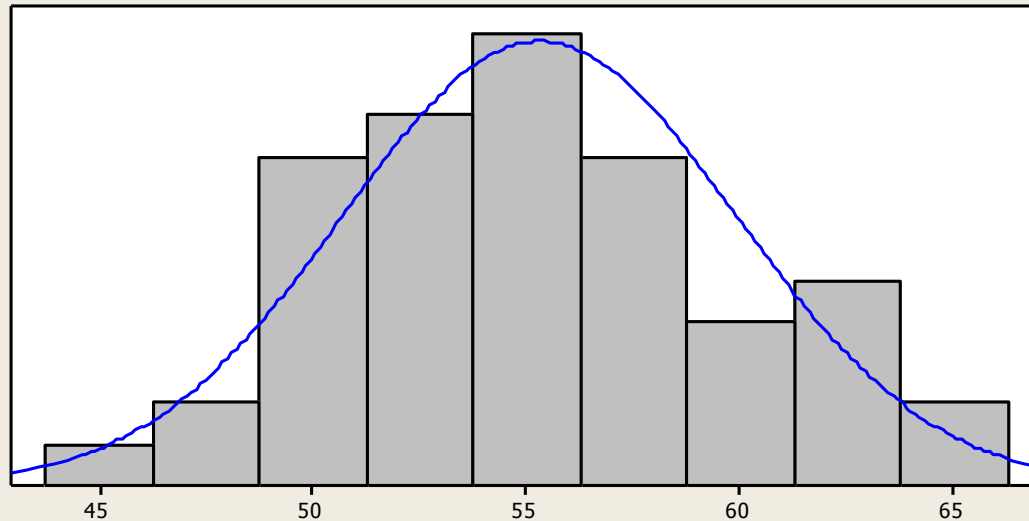
Buttons: Select, Help, OK, Cancel

Worksheet 1 Data:

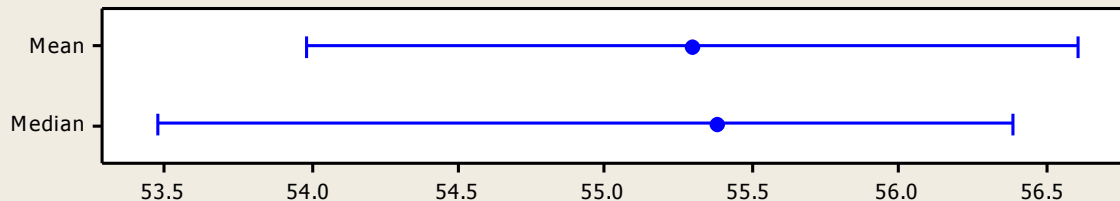
	C1	C2	C7	C8	C9
	Ticket Resolution Time (Mins)				
1	58.4280				
2	61.9191				
3	55.5001				
4	54.5446				
5	56.0525				
6	53.4576				
7	56.5868				
8	60.5157				
9	52.3213				

Graphical Summary

Summary for Ticket Resolution Time (Mins)



95 % Confidence Intervals



Anderson-Darling Normality Test

A-Squared	0.29
P-V value	0.594

Mean	55.297
StDev	4.617
Variance	21.314
Skewness	0.145280
Kurtosis	-0.365280
N	50

Minimum	44.910
1st Quartile	52.364
Median	55.387
3rd Quartile	57.965
Maximum	64.605

95% Confidence Interval for Mean	
53.985	56.609

95% Confidence Interval for Median	
53.474	56.389

95% Confidence Interval for StDev	
3.856	5.753

Normality Test

The screenshot displays the Minitab software interface. The 'Stat' menu is open, showing various statistical tests. The 'Normality Test...' option is highlighted. The 'Normality Test' dialog box is open, showing the 'Variable' field set to 'Ticket Resolution Time (Mins)'. The 'Tests for Normality' section has 'Anderson-Darling' selected. The 'Percentile Lines' section has 'None' selected. The 'Title' field is empty. The 'Session' window shows a summary for 'Ticket Resolution Time (Mins)'.

Stat Menu Options:

- Basic Statistics
 - Display Descriptive Statistics...
 - Store Descriptive Statistics...
 - Graphical Summary...
- Regression
 - 1-Sample Z...
 - 1-Sample t...
 - 2-Sample t...
 - Paired t...
- ANOVA
 - 1 Proportion...
 - 2 Proportions...
- DOE
 - 1-Sample Poisson Rate...
 - 2-Sample Poisson Rate...
- Control Charts
 - 1 Variance...
 - 2 Variances...
- Quality Tools
 - COR Correlation...
 - COV Covariance...
- Reliability/Survival
 - Normality Test...
 - Goodness-of-Fit Test for Poisson...
- Multivariate
- Time Series
- Tables
- Nonparametrics
- EDA
- Power and Sample Size

Normality Test Dialog Box:

Variable: Ticket Resolution Time (Mins)

Percentile Lines

- ☒ None
- ☐ At Y values:
- ☐ At data values:

Tests for Normality

- ☒ Anderson-Darling
- ☐ Ryan-Joiner (Similar to Shapiro-Wilk)
- ☐ Kolmogorov-Smirnov

Title:

Buttons: Select, Help, OK, Cancel

Session Window:

1/27/2011

Summary for Ticket Resolution Time (Mins)

	C1	C2
	Ticket Resolution Time (Mins)	
1	58.4280	
2	61.9191	
3	55.5001	
4	54.5446	
5	56.0525	
6	53.4576	
7	56.5868	
8	60.5157	
9	52.3213	

Test whether data follow a normal distribution

Histogram

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Scatterplot...
Matrix Plot...
Marginal Plot...
Histogram...
Dotplot...
Stem-and-Leaf...
Probability Plot...
Empirical CDF...
Probability Distribution Plot...
Boxplot...
Interval Plot...
Individual Value Plot...
Line Plot...
Bar Chart...
Pie Chart...
Time Series Plot...
Area Graph...
Contour Plot...
3D Scatterplot...
3D Surface Plot...

Session

1/27/2009 1

Summary for Ticket Re

Probability Plot of Ticke

Worksheet 1 ***

	C1	C4	C5	C6	C7	C8	C9
	Ticket Resolution Tim						
1							
2							
3							
4	54.5446						
5	56.0525						
6	53.4576						
7	56.5868						
8	60.5157						
9	52.3213						

Histograms

Simple With Fit

With Outline and Groups With Fit and Groups

Help OK Cancel

Histogram - With Fit

C1 Ticket Resolution Tim

Graph variables:
'Ticket Resolution Time (Mins)'

Scale... Labels... Data View...
Multiple Graphs... Data Options...

Select

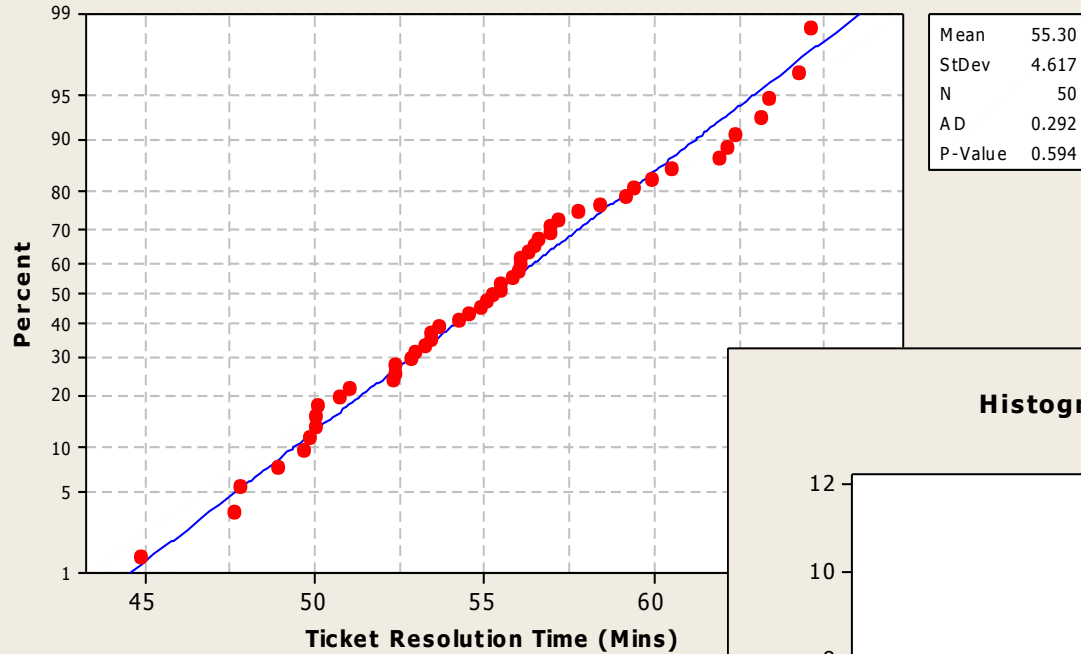
Help OK Cancel

Draw histograms

Normality Test - Histogram

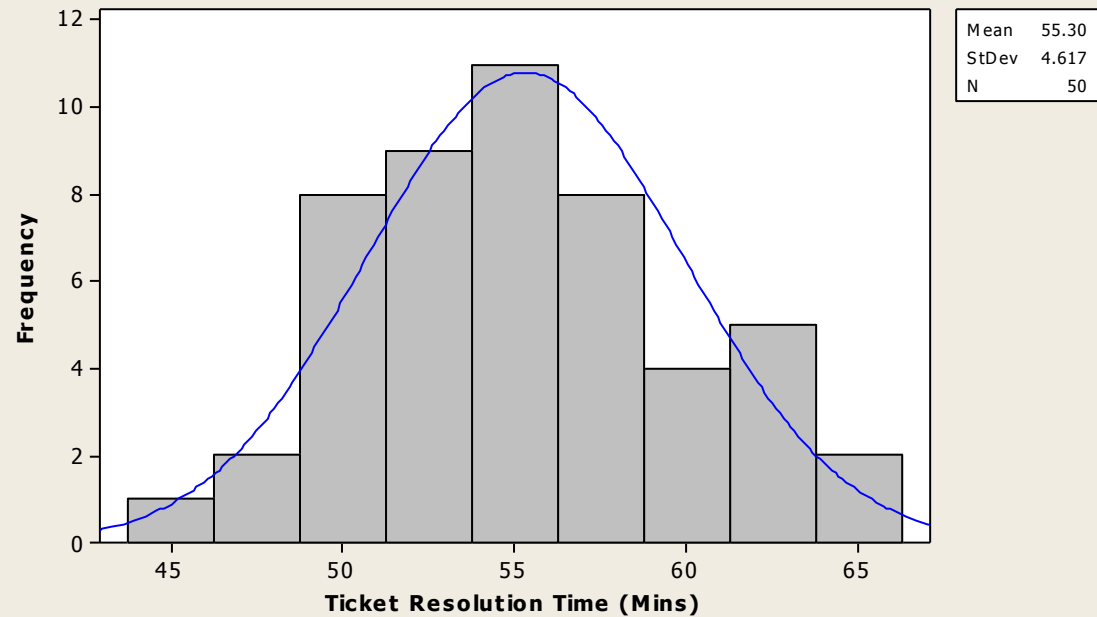
Probability Plot of Ticket Resolution Time (Mins)

Normal



Histogram of Ticket Resolution Time (Mins)

Normal



Box Plot

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Scatterplot...
Matrix Plot...
Marginal Plot...
Histogram...
Dotplot...
Stem-and-Leaf...
Probability Plot...
Empirical CDF...
Probability Distribution Plot...
Boxplot...
Interval Plot...
Individual Value Plot...
Line Plot...
Bar Chart...
Pie Chart...
Time Series Plot...
Area Graph...
Contour Plot...
3D Scatterplot...
3D Surface Plot...

Session

1/27/2009 1

Summary for Ticket Re

Probability Plot of Tick

Histogram of Ticket Re

Worksheet 1 ***

	C1	C4	C5	C6	C7
	Ticket Resolution Tim				
1					
2					
3					
4	54.5446				
5	56.0525				
6	53.4576				
7	56.5868				
8	60.5157				
9	52.3213				

Boxplots

One Y

Simple With Groups

Multiple Y's

Simple With Groups

Help OK Cancel

Boxplot - One Y, Simple

C1 Ticket Resolution Tim

Graph variables:
'Ticket Resolution Time (Mins)'

Scale... Labels... Data View...
Multiple Graphs... Data Options...

Select

Help OK Cancel

Draw box-and-whiskers plots

Dot Plot

The screenshot displays the Minitab software interface. The 'Graph' menu is open, showing various plot options. The 'Dotplot...' option is selected. The 'Dotplots' dialog box is open, showing the 'One Y' section with the 'Simple' option selected. The 'Dotplot - One Y, Simple' dialog box is also open, showing the 'Graph variables' section with 'Ticket Resolution Time (Mins)' selected.

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Scatterplot...
Matrix Plot...
Marginal Plot...
Histogram...
Dotplot...
Stem-and-Leaf...
Probability Plot...
Empirical CDF...
Probability Distribution Plot...
Boxplot...
Interval Plot...
Individual Value Plot...
Line Plot...
Bar Chart...
Pie Chart...
Time Series Plot...
Area Graph...
Contour Plot...
3D Scatterplot...
3D Surface Plot...

Session

Probability Plot of Tick...
Histogram of Ticket Re...
Boxplot of Ticket Reso...
Dotplot of Ticket Resol...

Worksheet 1 ***

	C1	C4	C5	C6	C7
	Ticket Resolution Tim				
1					
2					
3					
4	54.5446				
5	56.0525				
6	53.4576				
7	56.5868				
8	60.5157				
9	52.3213				

Dotplots

One Y

Simple With Groups Stack Groups

Multiple Y's

Simple Stack Y's With Groups Stack Groups

Help OK Cancel

Dotplot - One Y, Simple

C1 Ticket Resolution Tim

Graph variables:

Ticket Resolution Time (Mins)

Scale... Labels...
Multiple Graphs... Data Options...

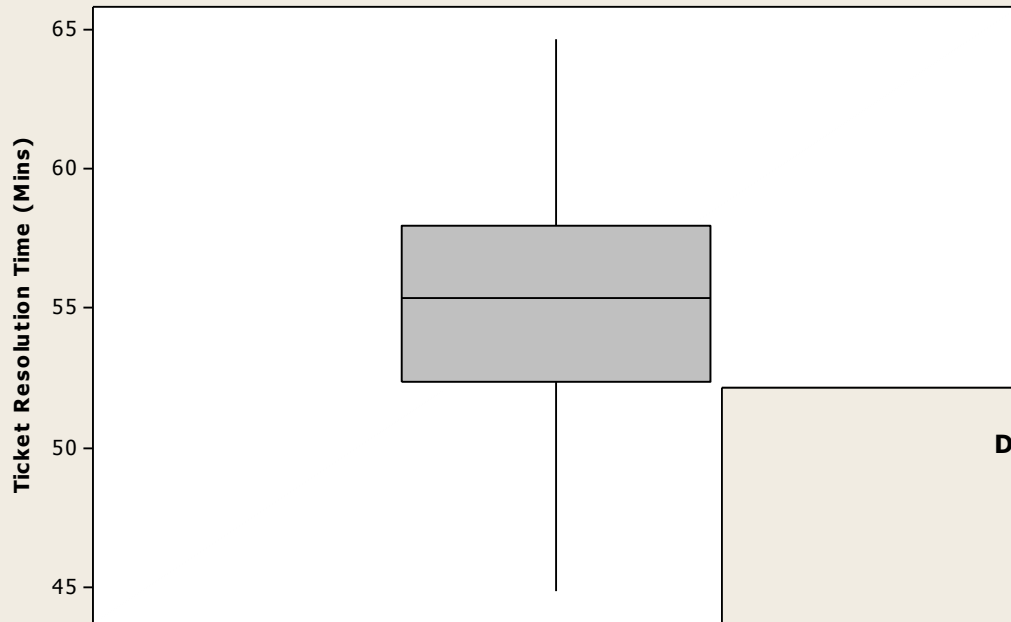
Select

Help OK Cancel

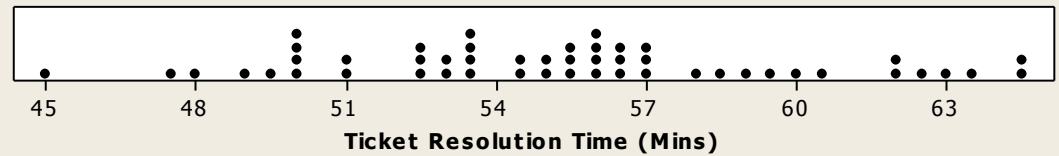
Draw plots with a dot for each observation along a number line

Box Plot - Dot Plot

Boxplot of Ticket Resolution Time (Mins)



Dotplot of Ticket Resolution Time (Mins)



Pareto Chart

The screenshot displays the Minitab software interface. The 'Stat' menu is open, and the 'Pareto Chart...' option is selected. The 'Pareto Chart' dialog box is open, showing the following settings:

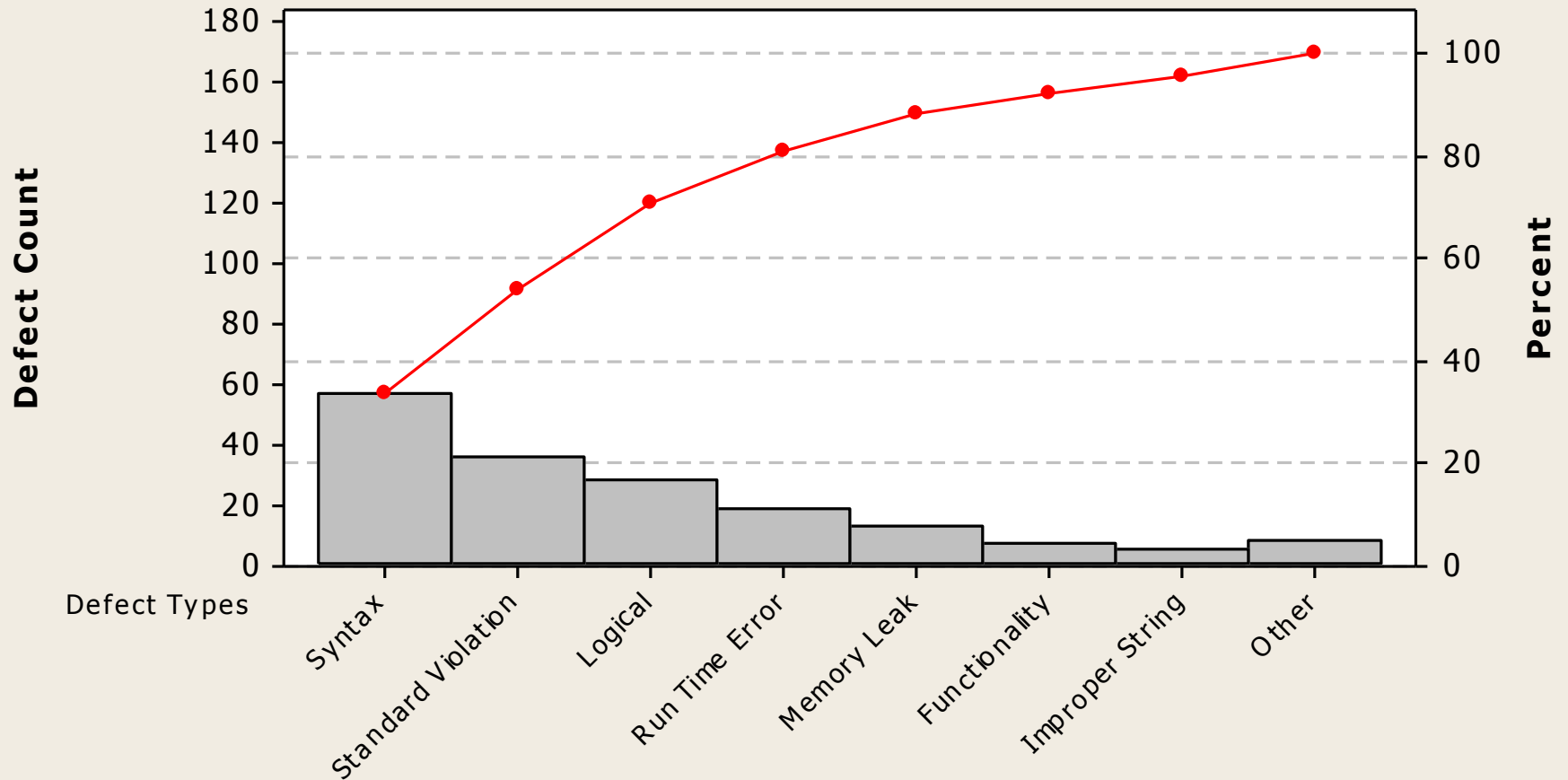
- Chart defects data in: C3
- BY variable in: Defect Count (optional)
- Chart defects table:
 - Labels in: 'Defect Types'
 - Frequencies in: 'Defect Count'
- Combine remaining defects into one category after this percent: 95
- Do not combine

The data table is visible in the background, showing the following data:

	C1	C2-T	C3
		Defect Types	Defect Count
1		Standard Violation	55
2		Syntax	48
3		Logical	12
4		Data Corruption	2
5		Functionality	11
6		Improper String	5
7		Compile Time error	1
8		Set up Error	2
9		Environment Mismatch	3

Pareto Chart

Pareto Chart of Defect Types



Defect Count	56	35	28	18	12	7	5	8
Percent	33.1	20.7	16.6	10.7	7.1	4.1	3.0	4.7
Cum %	33.1	53.8	70.4	81.1	88.2	92.3	95.3	100.0

Cause & Effect Diagram

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Basic Statistics
Regression
ANOVA
DOE
Control Charts
Quality Tools
Reliability/Survival
Multivariate
Time Series
Tables
Nonparametrics
EDA
Power and Sample Size

Run Chart...
Pareto Chart...
Cause-and-Effect...
Individual Distribution Identification...
Johnson Transformation...
Capability Analysis
Capability Sixpack
Gage Study
Attribute Agreement Analysis...
Acceptance Sampling by Attributes...
Acceptance Sampling by Variables
Multi-Vari Chart...
Symmetry Plot...

Session

1/28/20

Worksheet 1 ***

	C1-T	C2-T	
	Operating System	Hardware	
1	File System Capacity	Disk Problem	Tape not loaded
2	CPU Utilization	CPU Problem	Faulty Media
3	Memory Utilization	LAN Card Problem	Drive Problem
4	Swap Utilization	Memory Problem	Backup overrun
5	System Panic	Printer Problem	Scheduler Problem
6	Services not running	Network Errors	Tapes write protected
7	Printing Issues	Drive Broken	
8	File permission	Power Supply failures	
9	Job failures		

Project...

Draw a Cause-and-Effect diagram

Cause-and-Effect Diagram

C1 Operating System
C2 Hardware
C3 Back Up
C4 Application

Branch	Causes	Label
1	In column 'Operating System'	Operating Syst
2	In column Hardware	Hardware
3	In column 'Back Up'	Back Up
4	In column Application	Application
5	In column	
6	In column	
7	In column	
8	In column	
9	In column	
10	In column	

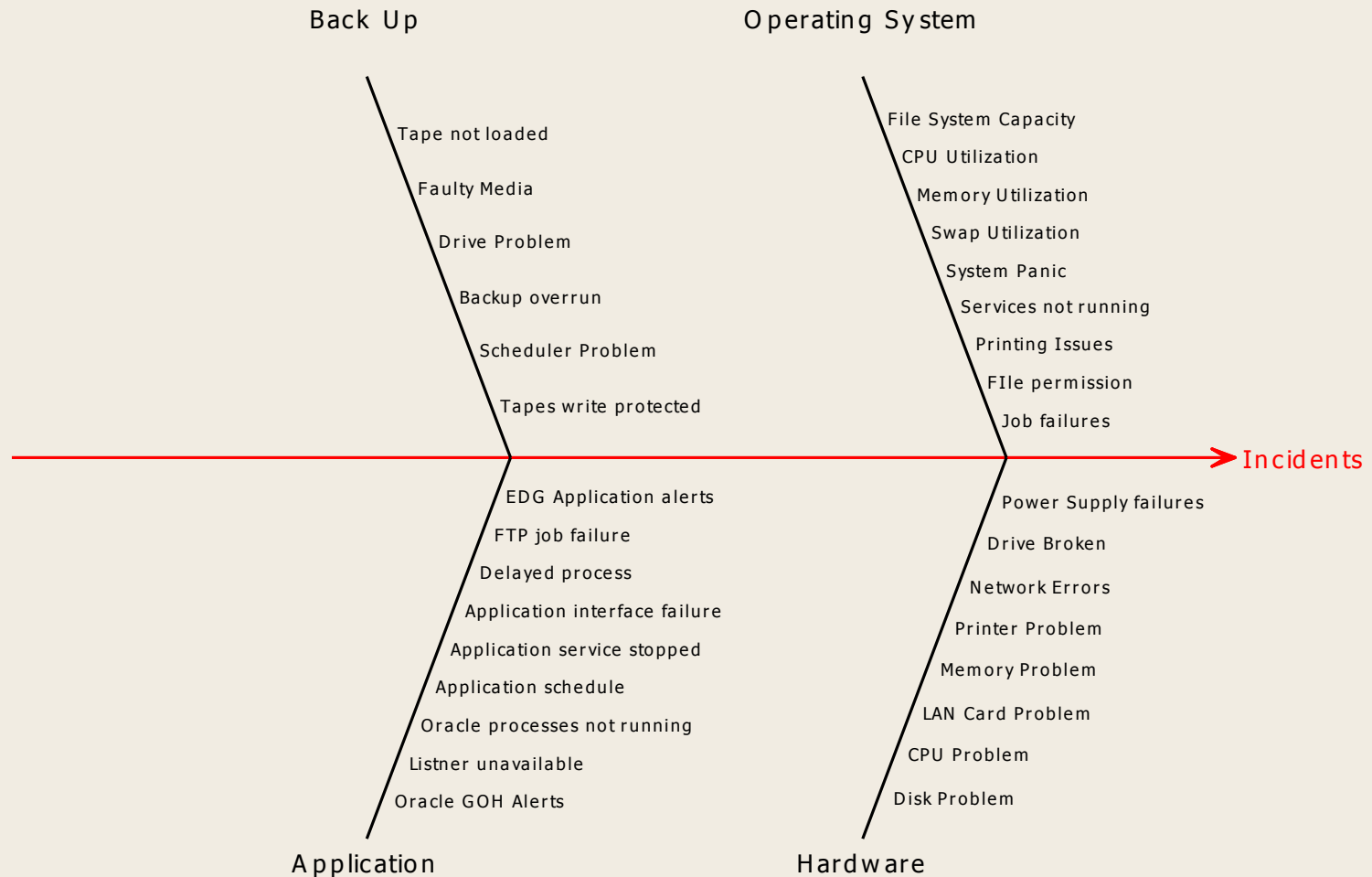
Effect: Incidents

Title:

☐ Do not label the branches ☒ Do not display empty branches

Cause & Effect Diagram

Cause-and-Effect Diagram



Minitab 15 : Intermediate & Advanced Tools

Minitab 15 : ANOVA

Topics

- One-Way ANOVA
- Two-Way ANOVA

One-way ANOVA

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Basic Statistics
Regression
ANOVA
DOE
Control Charts
Quality Tools
Reliability/Survival
Multivariate
Time Series
Tables
Nonparametrics
EDA
Power and Sample Size

One-Way...
One-Way (Unstacked)...
Two-Way...
Analysis of Means...
AOV Balanced ANOVA...
GLM General Linear Model...
Fully Nested ANOVA...
Balanced MANOVA...
General MANOVA...
Test for Equal Variances...
Interval Plot...
Main Effects Plot...
Interactions Plot...

Session

1/28/2009

Worksheet 1 ***

	C1-T Experience Level	C2 Defect Count	C3	C4 <1 Year	C5 1~4 Years	C6 >4 Years	C7	C8	C9	C10
1	<1 Year	222		222	129	60				
2	<1 Year	218		218	124	62				
3	<1 Year	217		217	126	76				
4	<1 Year	195		195	120	61				
5	<1 Year	201		201	127	75				
6	1~4 Years	129								
7	1~4 Years	124								
8	1~4 Years	126								
9	1~4 Years	120								

One-Way Analysis of Variance

Response: Defect Count

Factor: Experience Level

☐ Store residuals
☐ Store fits

Confidence level: 95.0

Select Comparisons... Graphs...
Help OK Cancel

Perform one-way analysis of variance on stacked data

One-way ANOVA

One-way ANOVA: Defect Count versus Experience Level

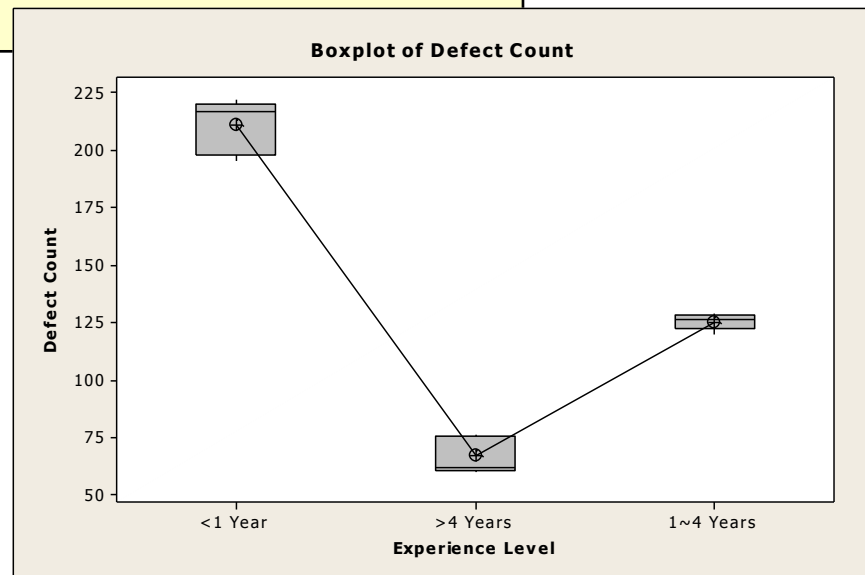
Source	DF	SS	MS	F	P
Experience Level	2	52303.6	26151.8	363.72	0.000
Error	12	862.8	71.9		
Total	14	53166.4			

S = 8.479 R-Sq = 98.38% R-Sq(adj) = 98.11%

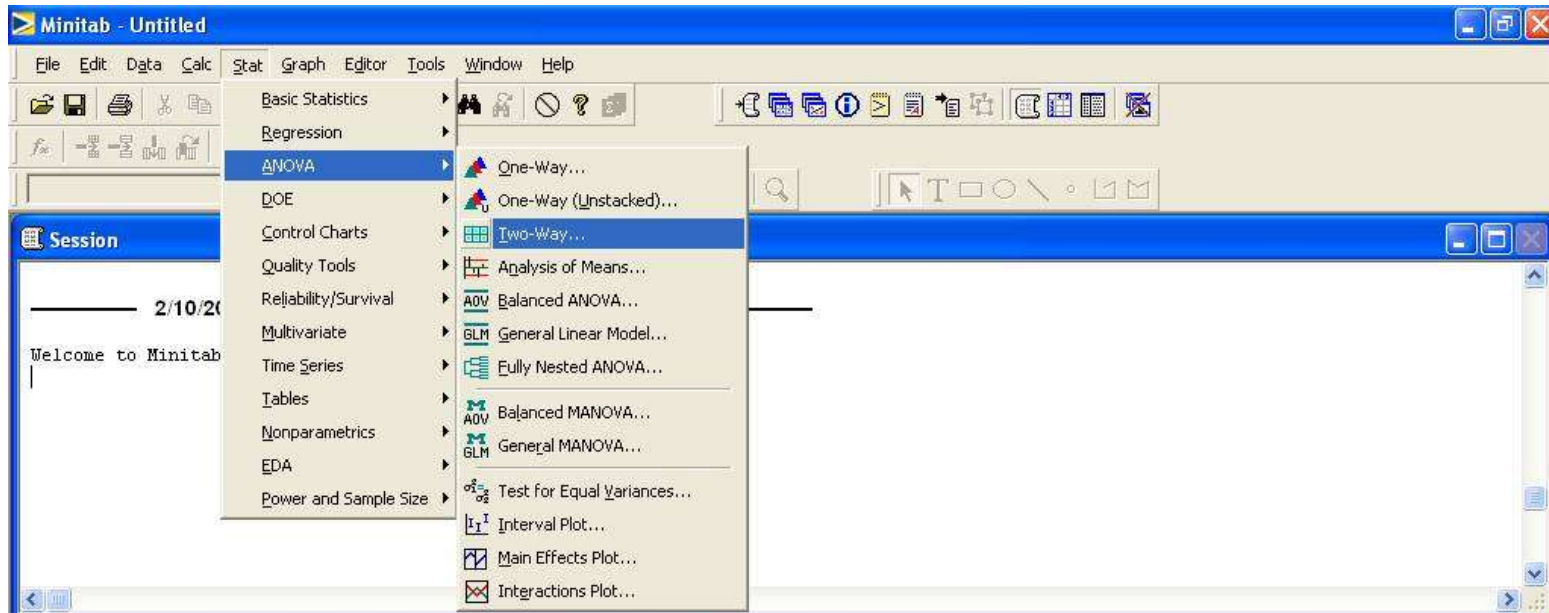
Individual 95% CIs For Mean Based on
Pooled StDev

Level	N	Mean	StDev	
<1 Year	5	210.60	11.84	(-*-)
>4 Years	5	66.80	7.98	(*-)
1~4 Years	5	125.20	3.42	(-*-)

Pooled StDev = 8.48



Two-way ANOVA

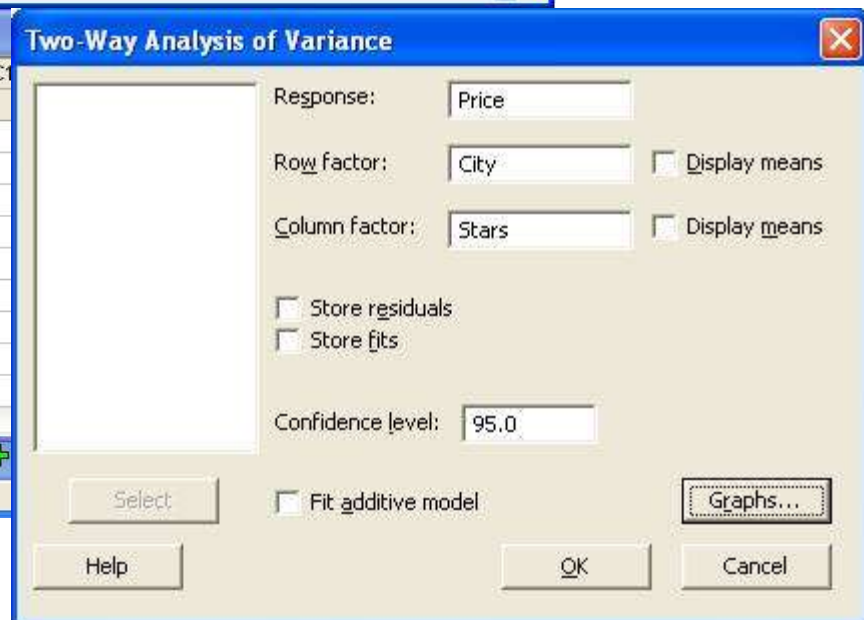


ANOVA HOTELS.MTW ***

	C1-T	C2-T	C3	C4	C5	C6	C7	C8	C9	C10
	City	Hotel	Stars	Price						
1	La	New Otani	3	119						
2	La	Hilton	3	150						
3	La	Beverly Plaza	3	110						
4	La	Hol Inn Conv	2	79						
5	La	Le Dufy	2	145						
6	La	Biltmore	2	140						
7	La	Le Parc	2	165						
8	La	Sheraton Grd	3	175						
9	SF	Hol Inn Fin	2	99						

Project...

Perform two-way analysis of variance for balanced data

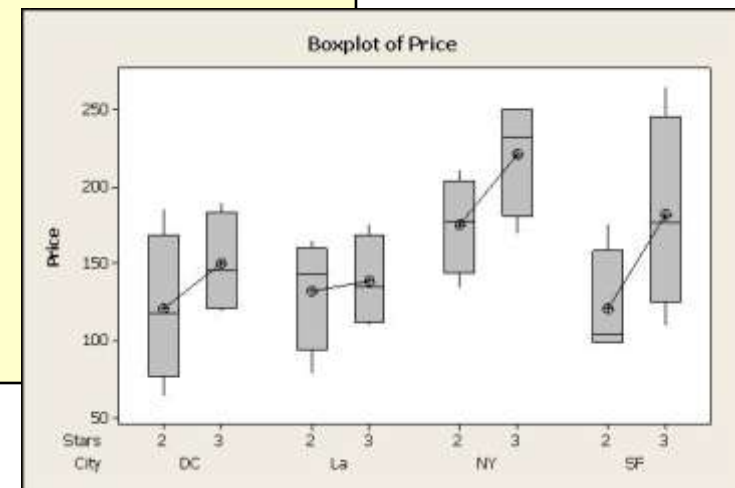
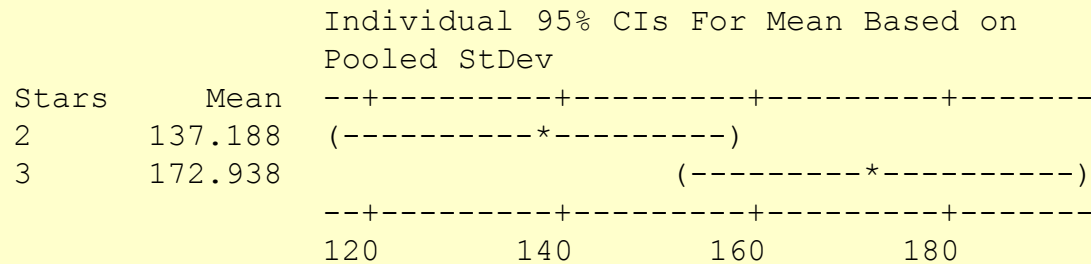
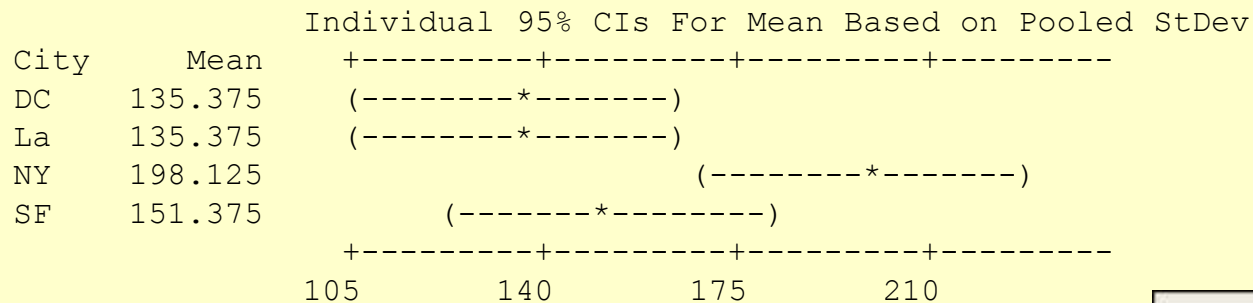


Two-way ANOVA

Two-way ANOVA: Price versus City, Stars

Source	DF	SS	MS	F	P
City	3	21145.4	7048.5	4.12	0.017
Stars	1	10224.5	10224.5	5.97	0.022
Interaction	3	3411.0	1137.0	0.66	0.582
Error	24	41079.0	1711.6		
Total	31	75859.9			

S = 41.37 R-Sq = 45.85% R-Sq(adj) = 30.05%

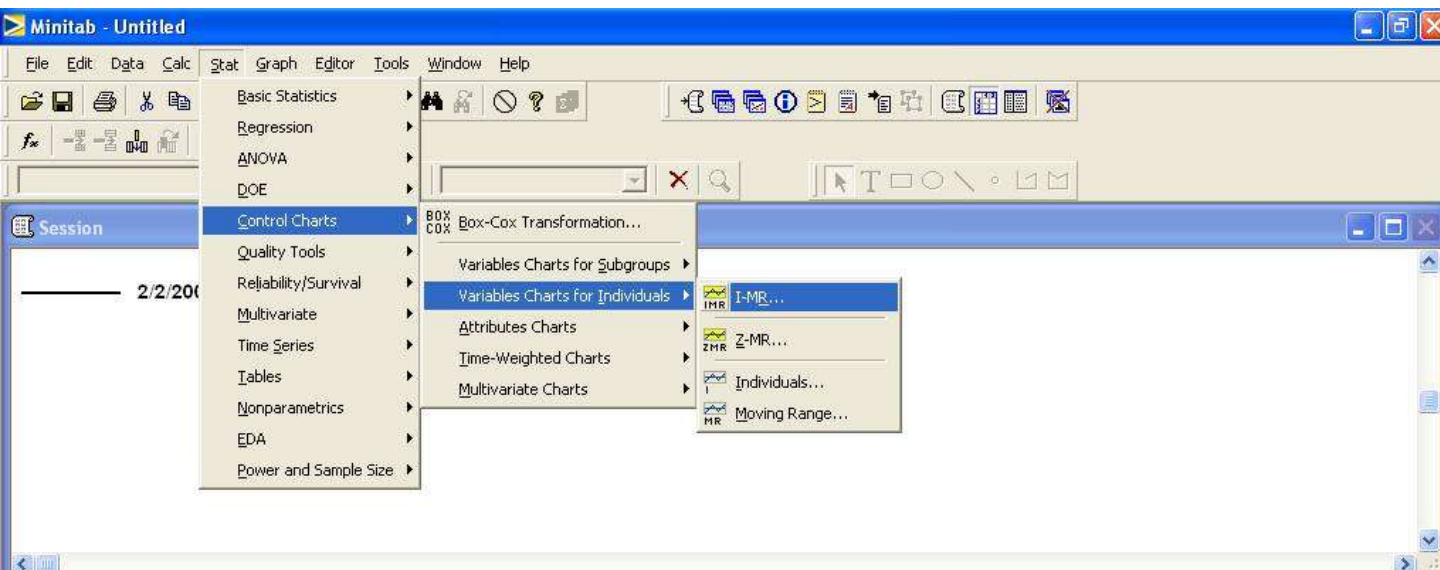


Minitab 15 : Control Charts

Topics

- I-MR
- X-Bar/R
- P-Chart
- NP-Chart
- U-Chart
- C-Chart

I-MR Chart

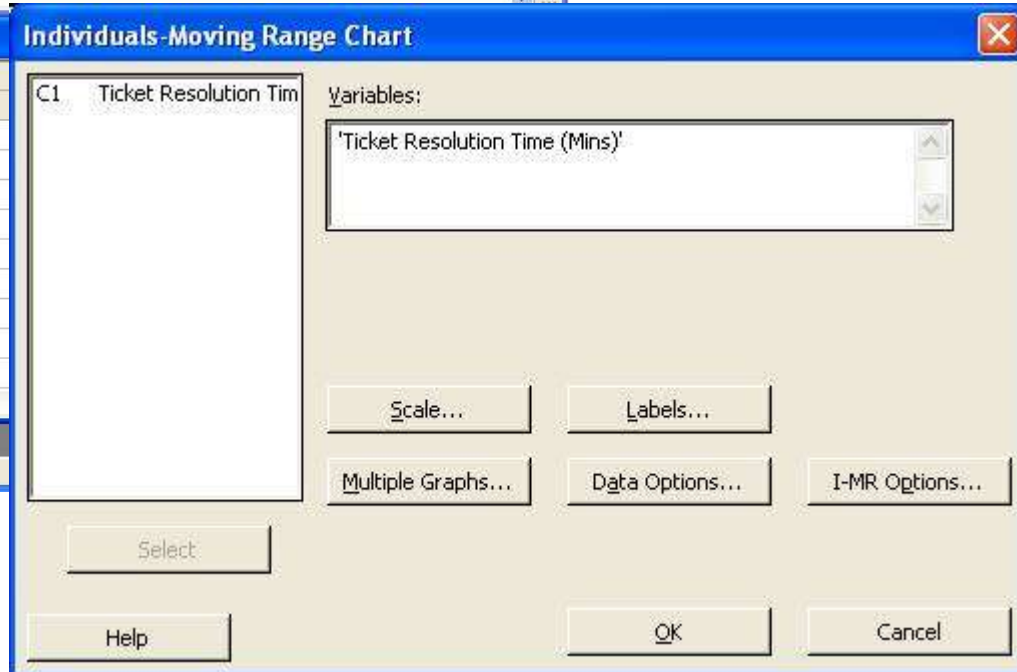


Worksheet 1 ***

	C1	C2	C3	C4	C5	C6	C7
	Ticket Resolution Time (Mins)						
1	58.43						
2	61.92						
3	55.50						
4	54.54						
5	56.05						
6	53.46						
7	56.59						
8	60.52						
9	52.32						

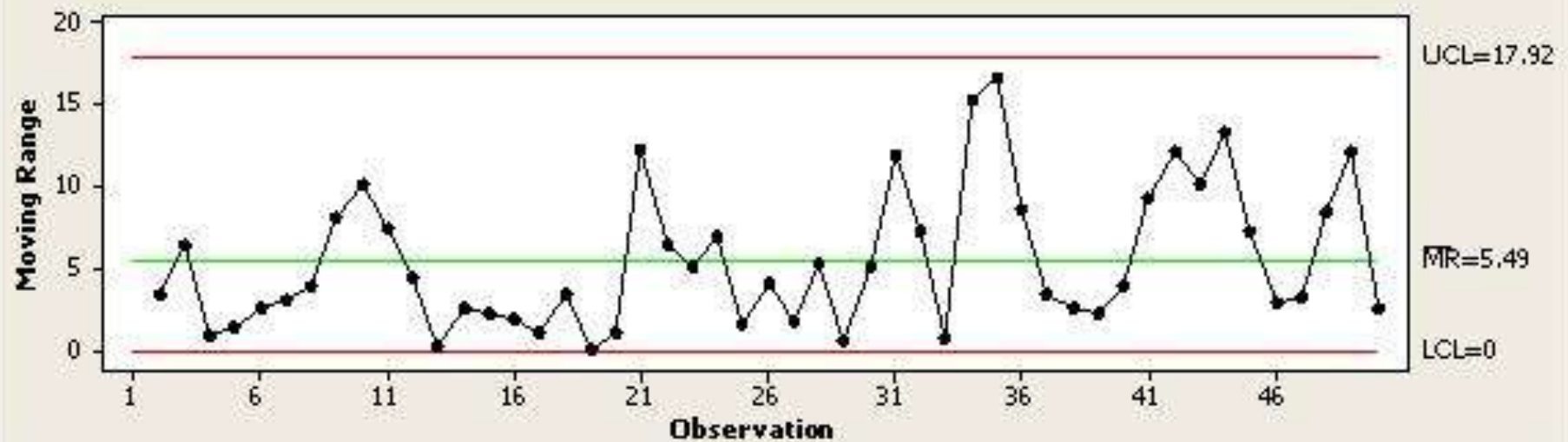
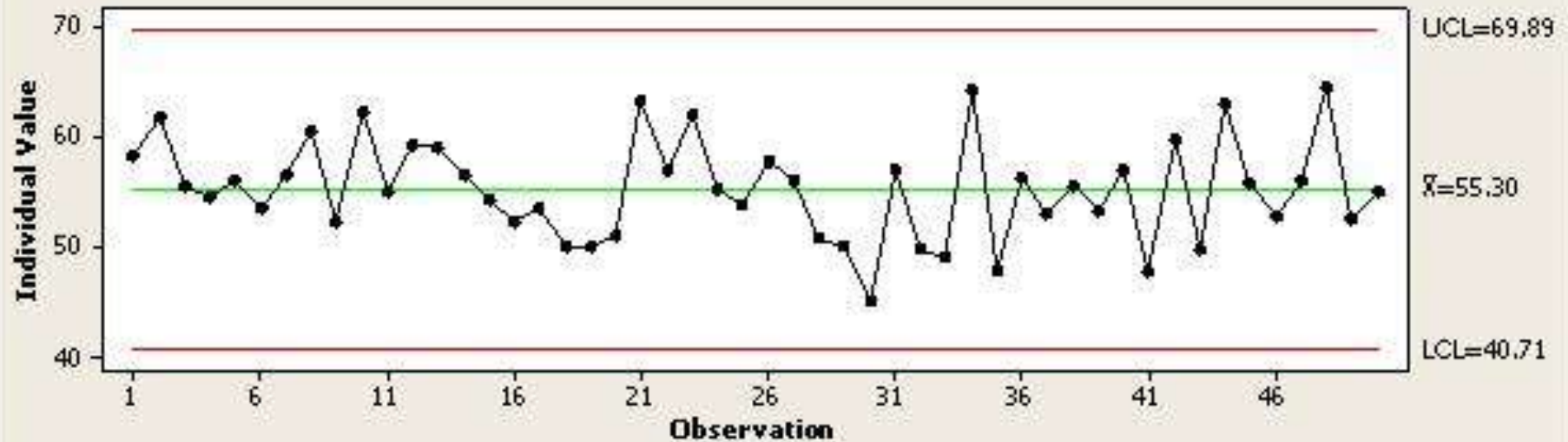
Project...

Draw control charts for observations and moving range charts



I-MR Chart

I-MR Chart of Ticket Resolution Time (Mins)



X-Bar/R Chart

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Basic Statistics
Regression
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Control Charts
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Reliability/Survival
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Power and Sample Size

Box-Cox Transformation...
Variables Charts for Subgroups
Variables Charts for Individuals
Attributes Charts
Time-Weighted Charts
Multivariate Charts

Xbar-R...
Xbar-S...
I-MR-R/S (Between/within)...
Xbar...
R...
S...
Zone...

Worksheet 1 ***

	C1	C2	C3	C4	C5	C6	C7
		Response Time (Mins)					
48		21					
49		23					
50		26					
51		24					
52		23					
53		21					
54		22					
55		20					
56							

Xbar-R Chart

C2 Response Time (Mins)

All observations for a chart are in one column:

'Response Time (Mins)'

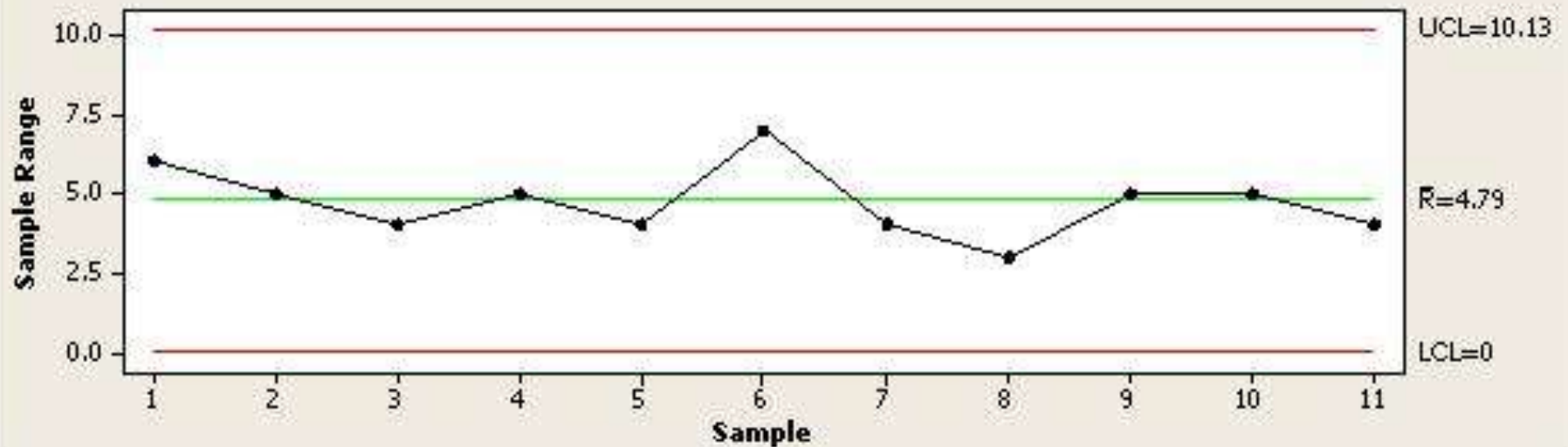
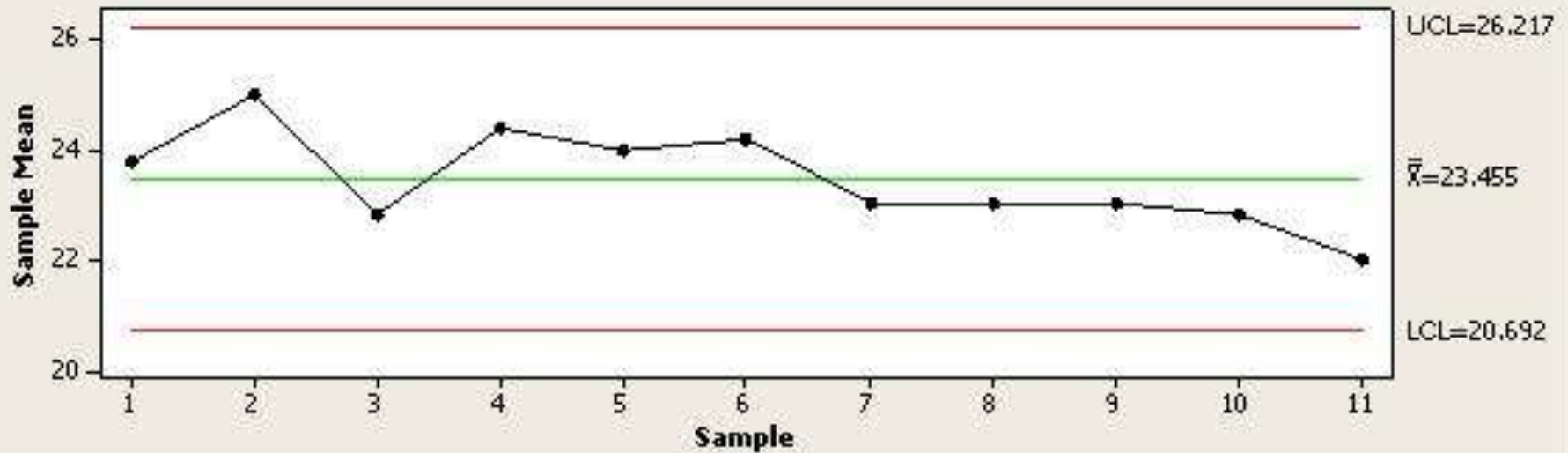
Subgroup sizes: 5 (enter a number or ID column)

Scale... Labels...
Multiple Graphs... Data Options... Xbar-R Options...
Select
Help OK Cancel

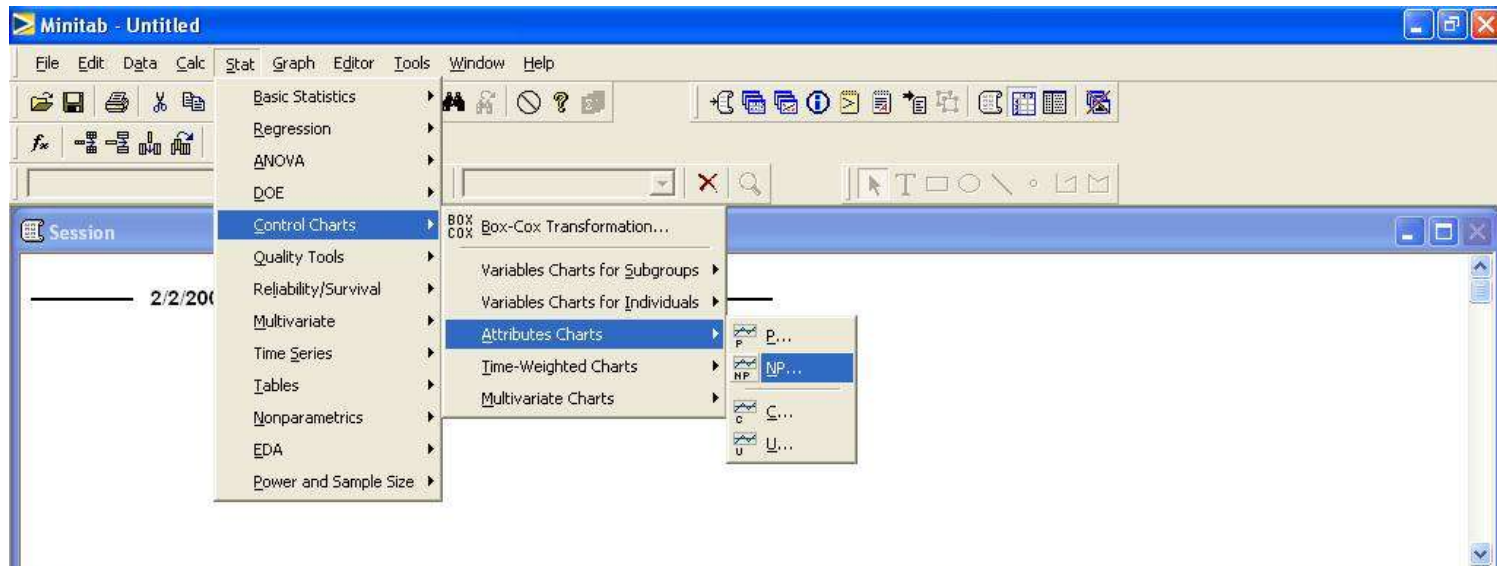
Draw control charts for subgroup means and ranges

X-Bar/R Chart

Xbar-R Chart of Response Time (Mins)



NP-Chart

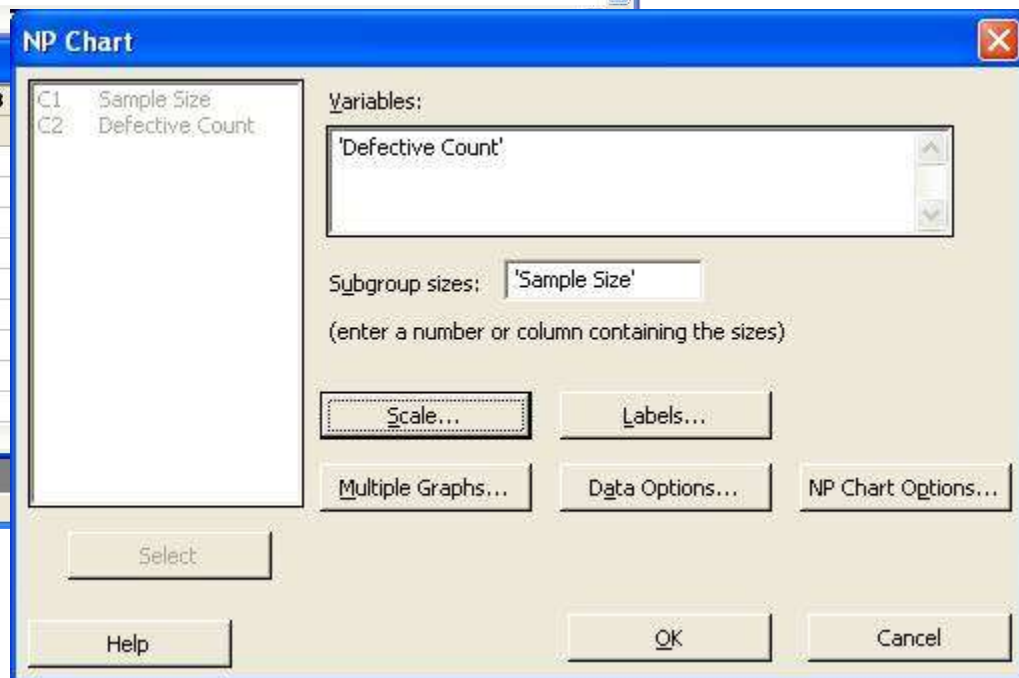


Worksheet 1 ***

	C1	C2	C3	C4	C5	C6	C7	C8
	Sample Size	Defective Count						
1	25	4						
2	25	4						
3	25	6						
4	25	7						
5	25	8						
6	25	6						
7	25	3						
8	25	9						
9	25	5						

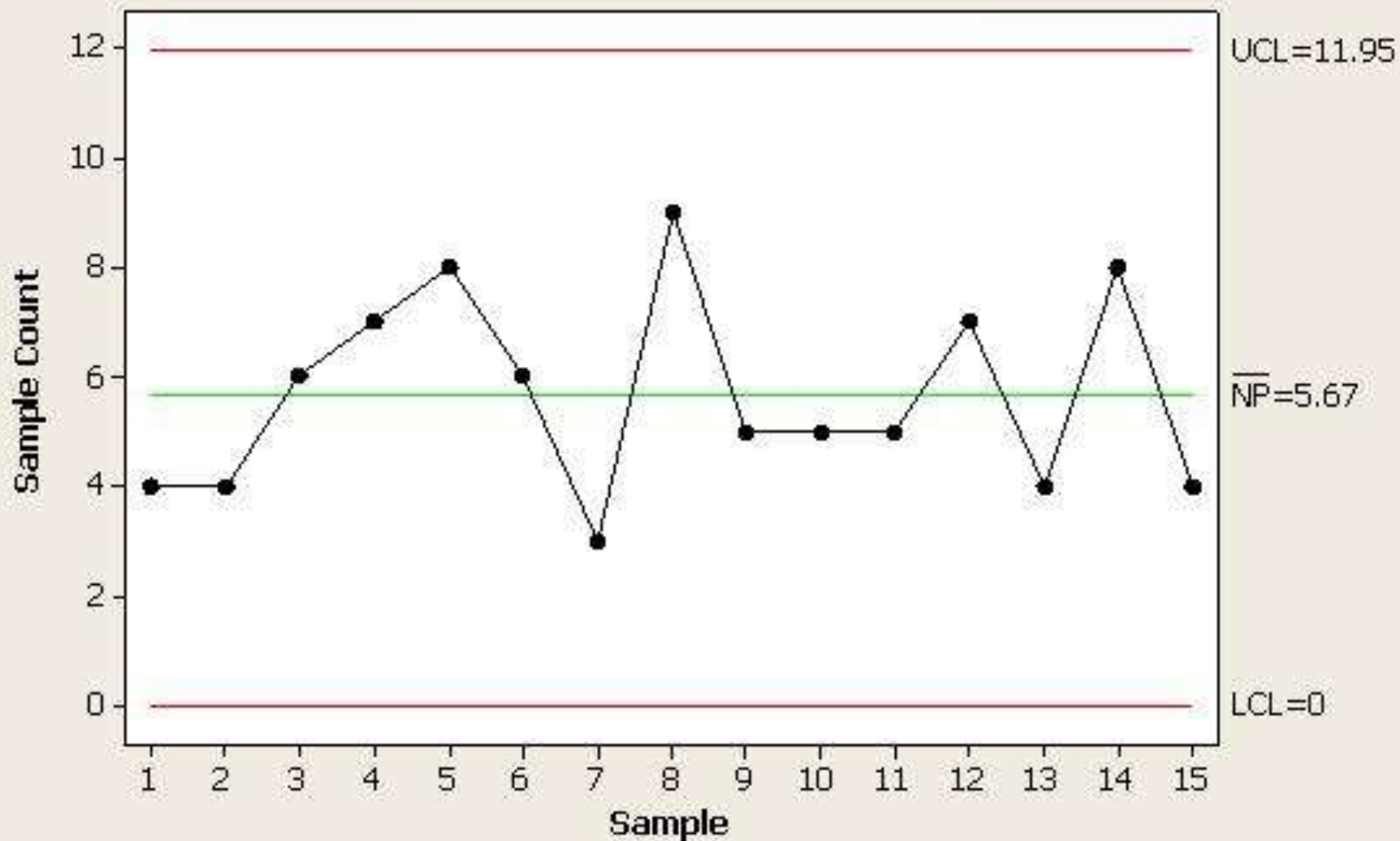
Project...

Draw a control chart for the number of defectives

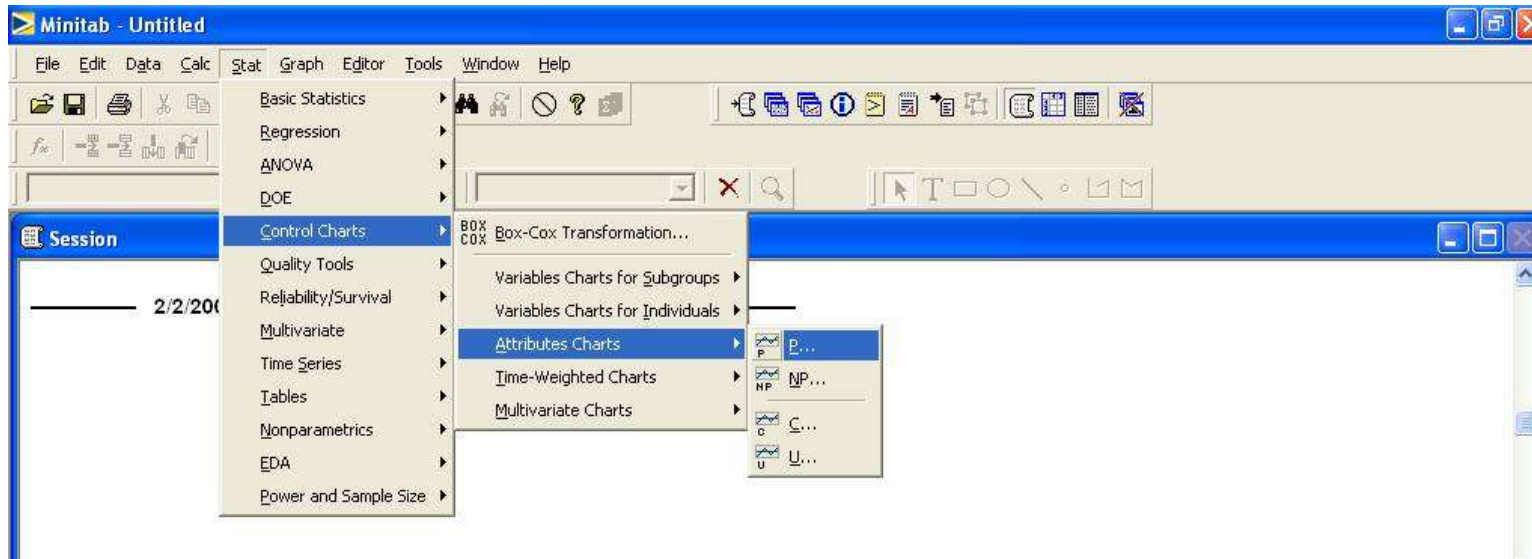


NP-Chart

NP Chart of Defective Count



P-Chart

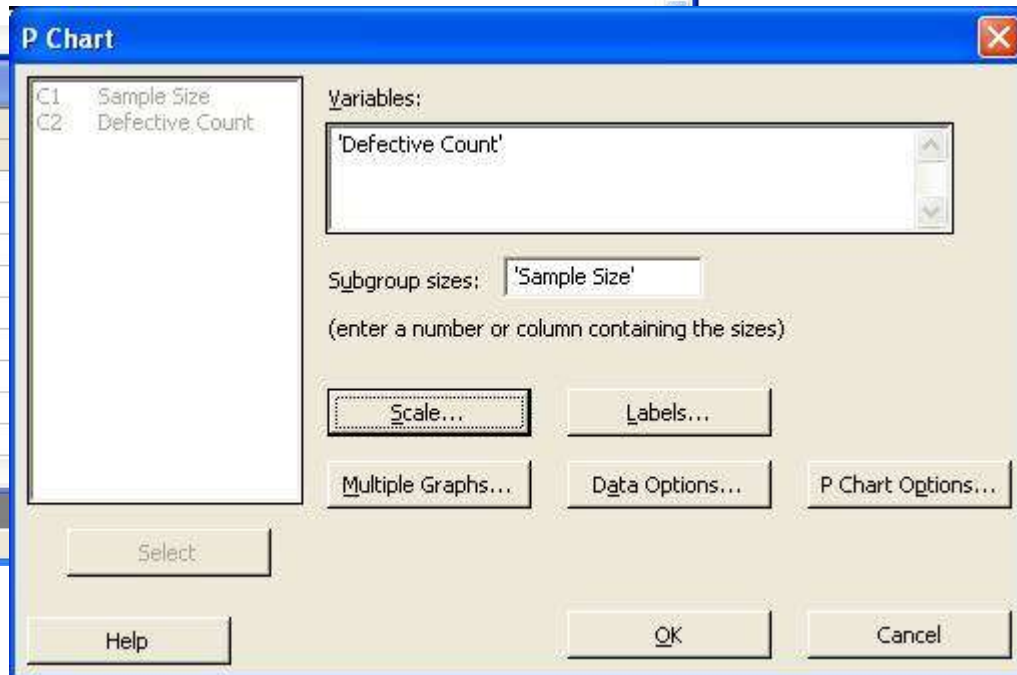


Worksheet 1

	C1	C2	C3	C4	C5	C6	C7
	Sample Size	Defective Count					
1	80	4					
2	110	4					
3	100	6					
4	105	7					
5	120	8					
6	107	6					
7	75	3					
8	115	9					
9	85	5					

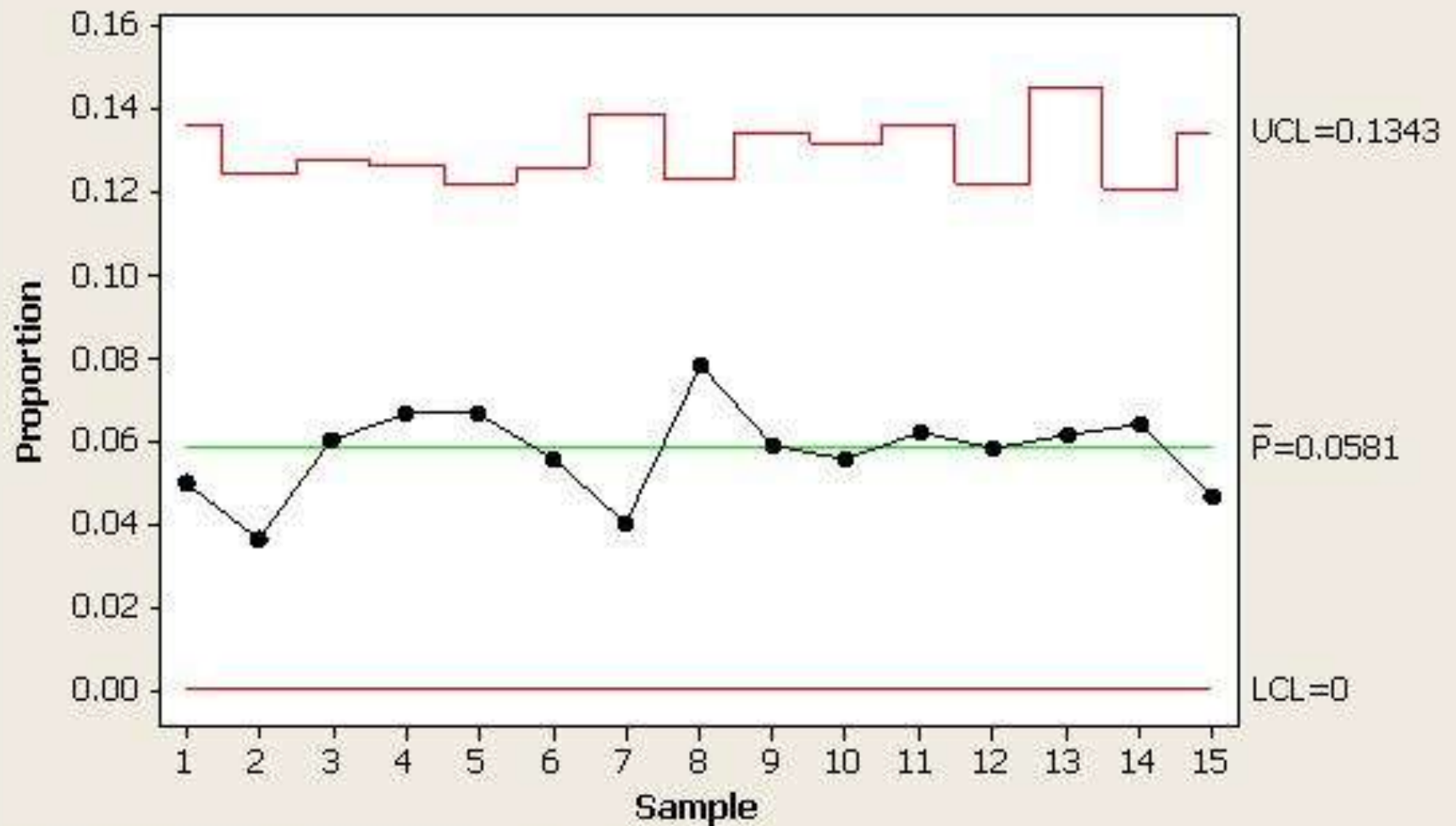
Project...

Draw a control chart for the proportion of defectives



P-Chart

P Chart of Defective Count



Tests performed with unequal sample sizes

U-Chart

The screenshot displays the Minitab software interface. The 'Stat' menu is open, leading to 'Control Charts', then 'Attributes Charts', and finally 'U...' is selected. The 'U Chart' dialog box is open, showing the following configuration:

- Variables:** 'Defect Count'
- Subgroup sizes:** 'Sample Size' (with a note: '(enter a number or column containing the sizes)')
- Buttons:** Scale..., Labels..., Multiple Graphs..., Data Options..., U Chart Options..., Select, Help, OK, Cancel.

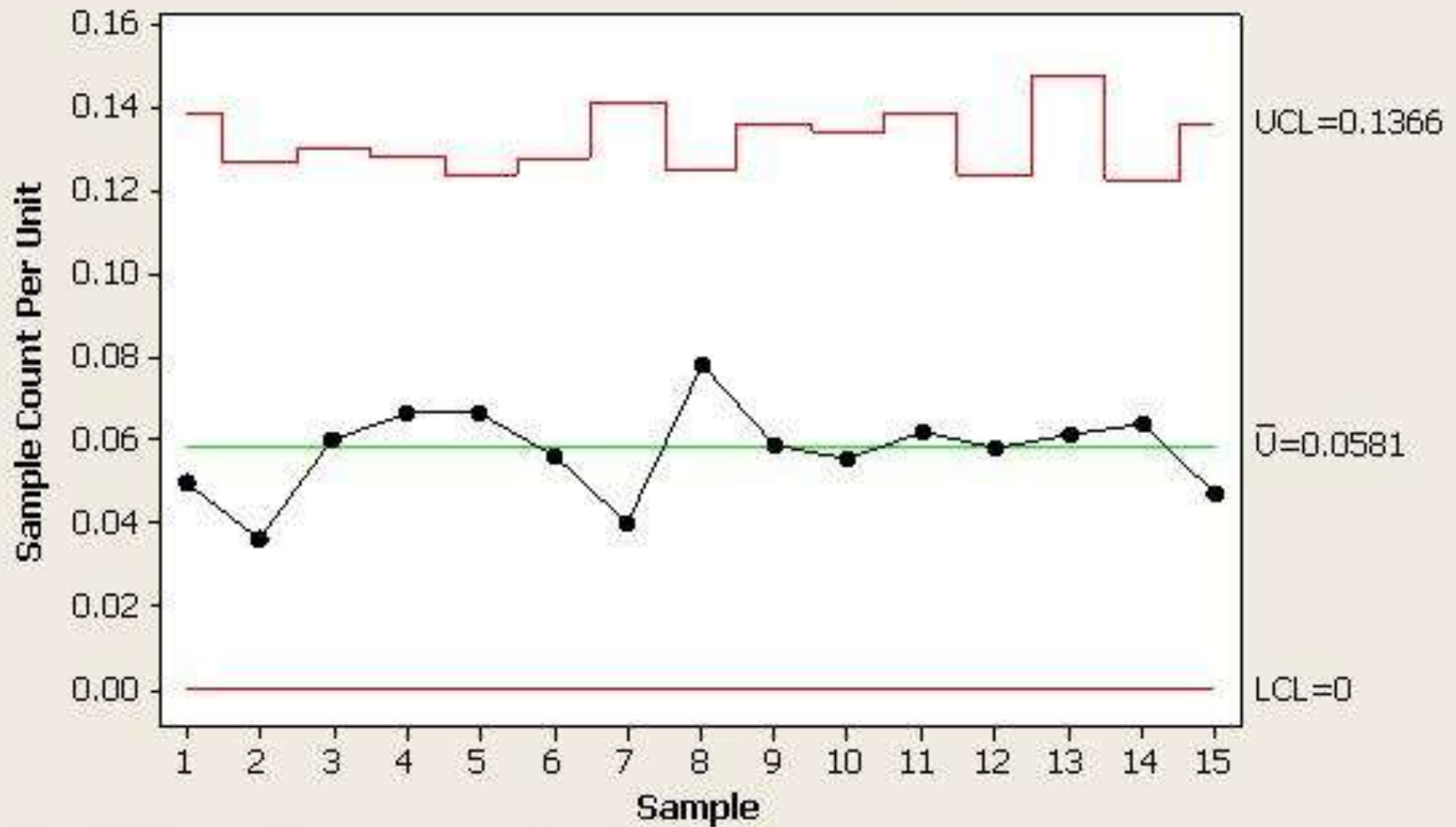
The background shows a worksheet with the following data:

	C1	C2	C3	C4	C5	C6	C7
	Sample Size	Defect Count					
1	80	4					
2	110	4					
3	100	6					
4	105	7					
5	120	8					
6	107	6					
7	75	3					
8	115	9					
9	85	5					

At the bottom of the Minitab window, a status bar message reads: "Draw a control chart for the number of defects per unit sampled".

U-Chart

U Chart of Defect Count



Tests performed with unequal sample sizes

C-Chart

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Basic Statistics
Regression
ANOVA
DOE
Control Charts
Quality Tools
Reliability/Survival
Multivariate
Time Series
Tables
Nonparametrics
EDA
Power and Sample Size

Box-Cox Transformation...
Variables Charts for Subgroups
Variables Charts for Individuals
Attributes Charts
Time-Weighted Charts
Multivariate Charts

P...
NP...
C...
U...

Session

2/9/200

Worksheet 1 ***

	C1	C2	C3	C4	C5	C6	C7
	Sample Size	Defect Count					
1	25	4					
2	25	4					
3	25	6					
4	25	7					
5	25	8					
6	25	6					
7	25	3					
8	25	9					
9	25	5					

C Chart

Variables:
'Defect Count'

Scale... Labels...
Multiple Graphs... Data Options... C Chart Options...

Select

Help

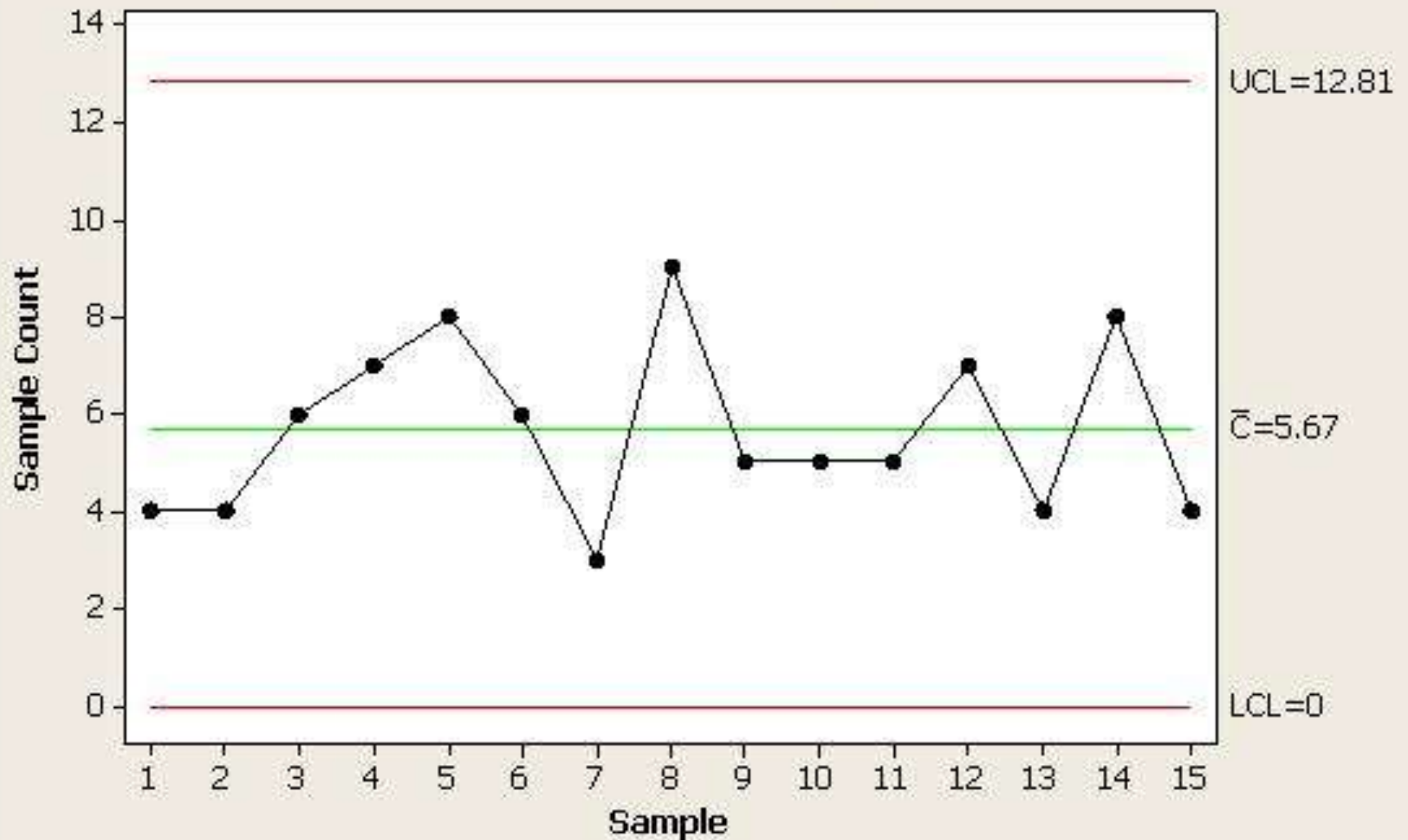
OK Cancel

Project...

Draw a control chart for the number of defects

C-Chart

C Chart of Defect Count



Minitab 15 : Capability Analysis

Capability Analysis : Normal

The screenshot shows the Minitab software interface. The 'Stat' menu is open, and the path 'Stat > Quality Tools > Capability Analysis > Normal...' is highlighted. The 'Worksheet 1' data table is visible in the background.

	C1	C2	C3
	Estimation Error		
1	9		
2	8		
3	9		
4	10		
5	14		
6	10		
7	8		
8	7		
9	15		

Capability Analysis (Normal Distribution)

Data are arranged as

☒ Single column: 'Estimation Error'

Subgroup size: 1
(use a constant or an ID column)

☐ Subgroups across rows of:

Lower spec: -15 ☐ Boundary

Upper spec: 15 ☐ Boundary

Historical mean: (optional)

Historical standard deviation: (optional)

Box-Cox...
Estimate...
Options...
Storage...

Select

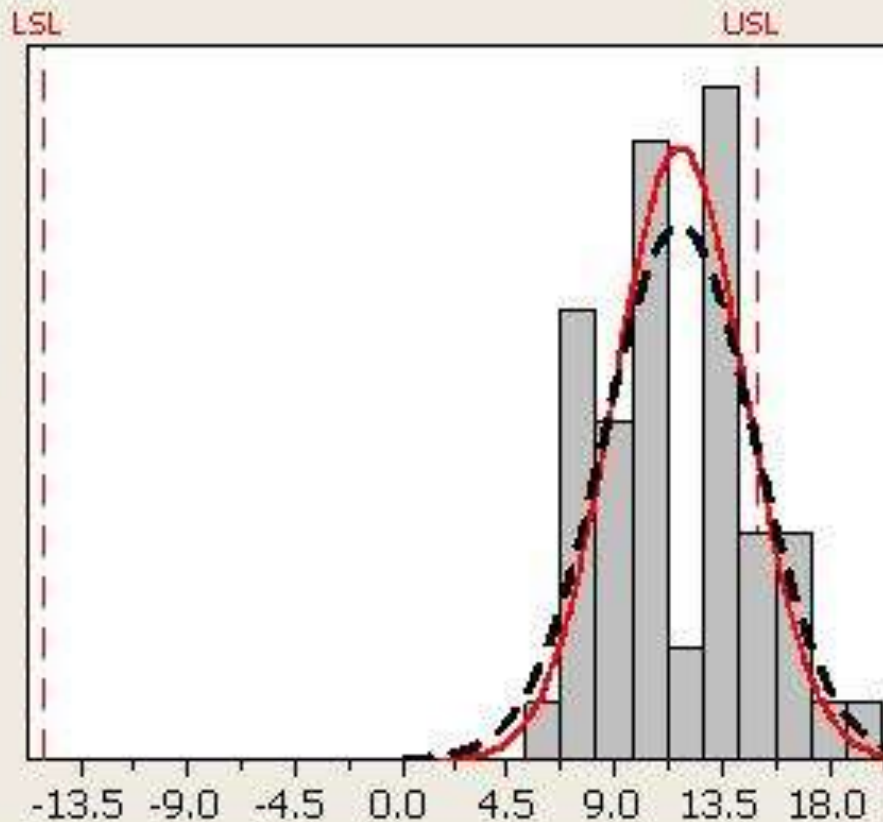
Help

OK
Cancel

Capability Analysis : Normal

Process Capability of Estimation Error

Process Data	
LSL	-15
Target	*
USL	15
Sample Mean	11.7
Sample N	50
StDev(Within)	2.75004
StDev(Overall)	3.14448



— Within
- - Overall

Potential (Within) Capability

Cp	1.82
CPL	3.24
CPU	0.40
Cpk	0.40

Overall Capability

Pp	1.59
PPL	2.83
PPU	0.35
Ppk	0.35
Cpm	*

Observed Performance	
PPM $\leq$ LSL	0.00
PPM $>$ USL	120000.00
PPM Total	120000.00

Exp. Within Performance	
PPM $\leq$ LSL	0.00
PPM $>$ USL	115072.74
PPM Total	115072.74

Exp. Overall Performance	
PPM $\leq$ LSL	0.00
PPM $>$ USL	146983.67
PPM Total	146983.67

Capability Analysis : Binomial

Worksheet 1 ***

	C1	C2	C3	C4
	Sample	Defective		
1	258	12		
2	239	8		
3	209	5		
4	273	3		
5	269	8		
6	247	2		
7	228	3		
8	204	7		
9	227	5		

Project... Analyze data that follow a binomial distribution

Capability Analysis (Binomial Distribution)

Defectives: Defective Tests... Options... Storage...

Sample size
☐ Constant size:
☒ Use sizes in: Sample

Historical p: (optional)

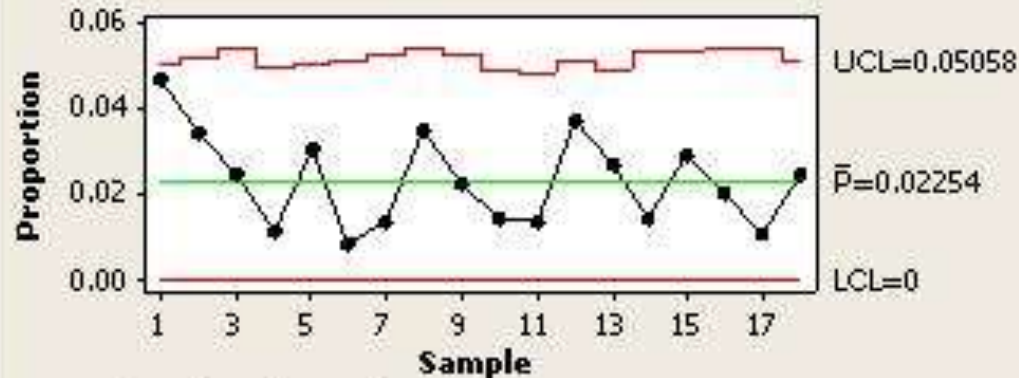
Enter a target %Defective for this process (optional)
Target:

Select Help OK Cancel

Capability Analysis : Binomial

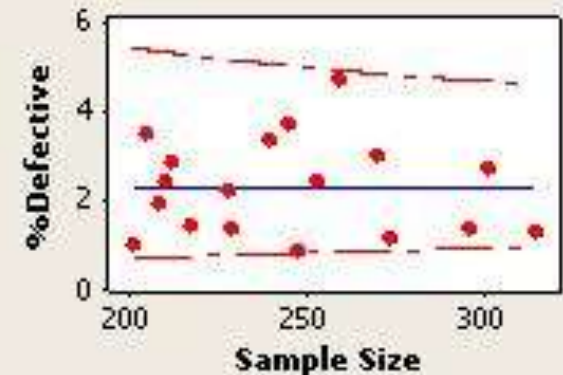
Binomial Process Capability Analysis of Defective

P Chart

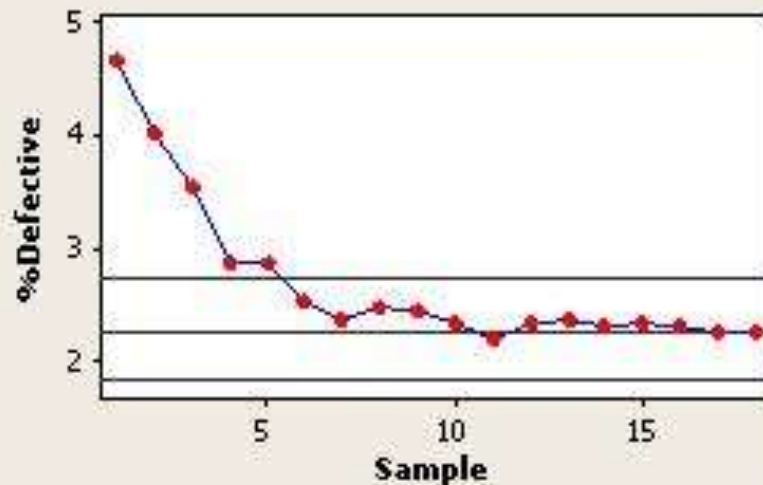


Tests performed with unequal sample sizes

Rate of Defectives

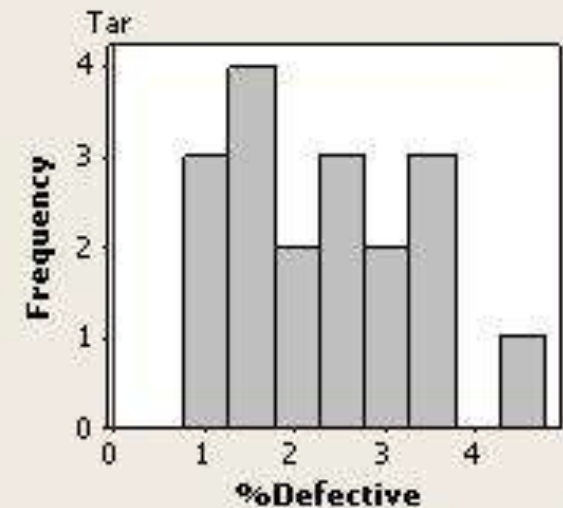


Cumulative %Defective



Summary Stats (95.0% confidence)	
%Defective:	2.25
Lower CI:	1.84
Upper CI:	2.74
Target:	0.00
PPM Def:	22536
Lower CI:	18353
Upper CI:	27369
Process Z:	2.0040
Lower CI:	1.9209
Upper CI:	2.0890

Histogram



Capability Analysis : Poisson

The screenshot displays the Minitab software interface. The main window shows a worksheet with data for a Binomial Process. The 'Stat' menu is open, and the 'Capability Analysis' option is selected. The 'Capability Analysis (Poisson Distribution)' dialog box is open, showing the following settings:

- Defects: Defect
- Sample size: ☐ Constant size: 1 ☒ Use sizes in: Sample
- Historical mu: (optional)
- Enter a target DPU for this process (optional): Target: 0

The dialog box also includes buttons for 'Tests...', 'Options...', 'Storage...', 'Select', 'Help', 'OK', and 'Cancel'.

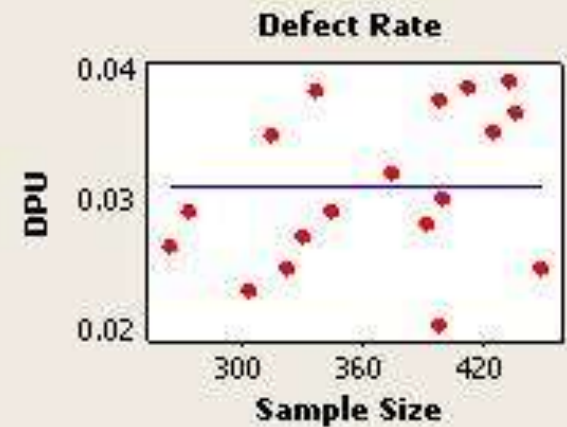
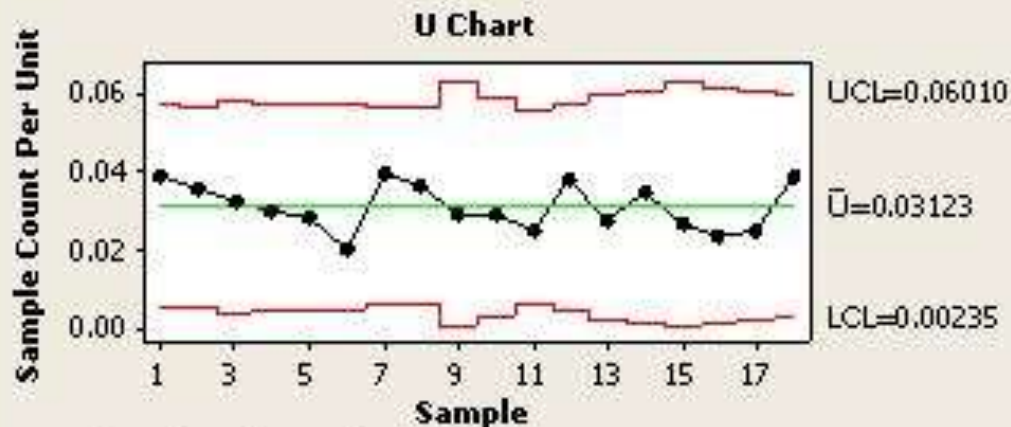
Worksheet 1 ***

	C1	C2	C3	C4
	Sample	Defect		
1	411	16		
2	423	15		
3	374	12		
4	399	12		
5	391	11		
6	397	8		
7	431	17		
8	435	16		
9	274	8		

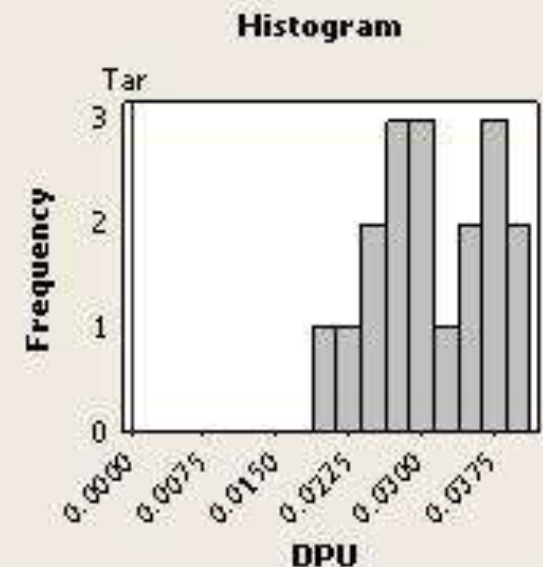
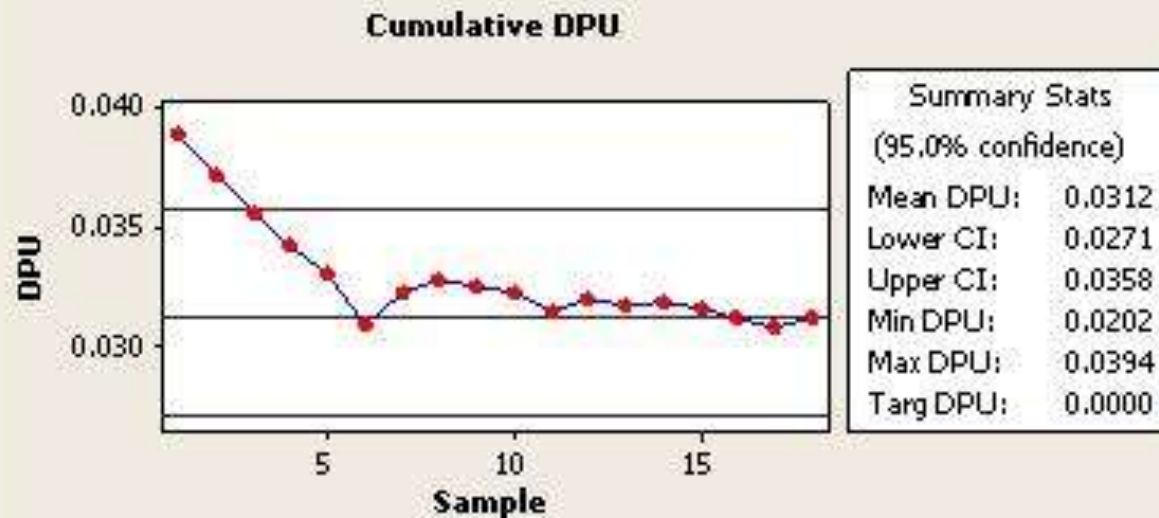
Analyze data that follow a Poisson distribution

Capability Analysis : Poisson

Poisson Capability Analysis of Defect



Tests performed with unequal sample sizes



Minitab 15 : Correlation-Regression

Topics

- Scatter Plot
- Correlation
- Regression

Scatter Plot

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Scatterplot...
Matrix Plot...
Marginal Plot...
Histogram...
Dotplot...
Stem-and-Leaf...
Probability Plot...
Empirical CDF...
Probability Distribution Plot...
Boxplot...
Interval Plot...
Individual Value Plot...
Line Plot...
Bar Chart...
Pie Chart...
Time Series Plot...
Area Graph...

Session

2/9/2009 6:00

Worksheet 1 ***

	C1	C2	C6	C7	C8	C9	C10
	Productivity	Experience	length	Defect Count	Resource Experience	Effort	
1	840						
2	730						
3	930						
4	580	60					
5	710	69					
6	560	52					
7	820	63					
8	880	84					
9	900	72					

Scatterplots

Simple With Groups With Regression With Regression and Groups

With Connect Line With Connect and Groups

Help OK Cancel

Scatterplot - With Regression

C1 Productivity
C2 Experience
C5 Code Length
C6 Defect Count
C7 Resource Experience
C8 Effort

	Y variables	X variables
1	Productivity	Experience
2		
3		
4		
5		
6		
7		

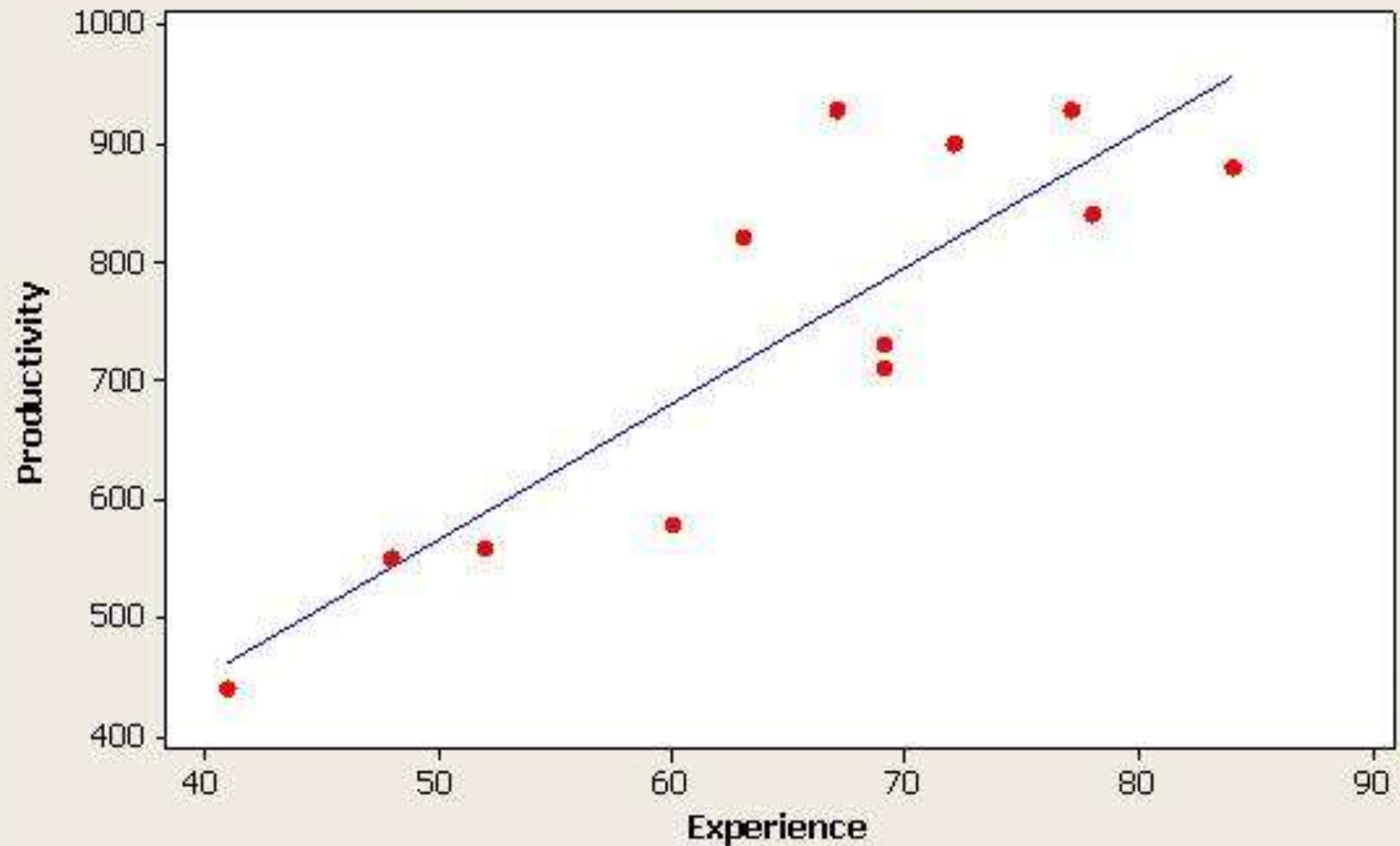
Scale... Labels... Data View...
Multiple Graphs... Data Options...

Select

Help OK Cancel

Scatter Plot

Scatterplot of Productivity vs Experience



Correlation

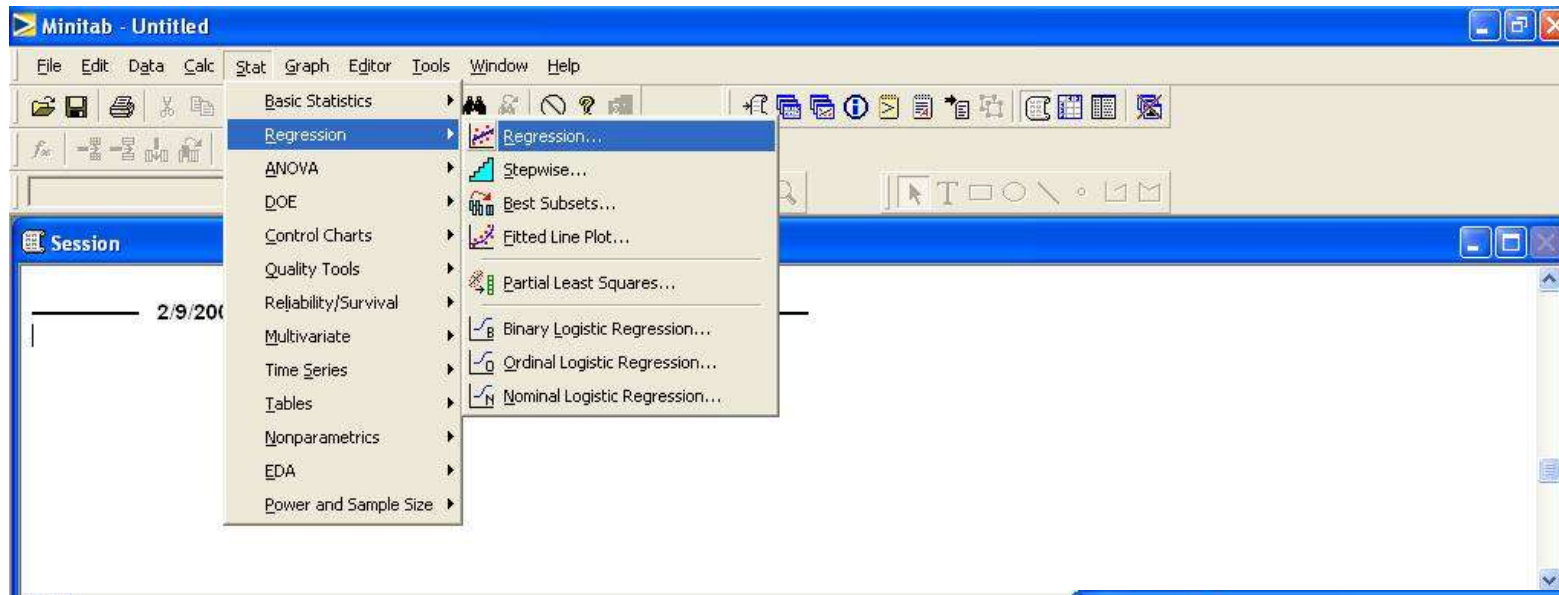
The screenshot shows the Minitab software interface. The 'Stat' menu is open, and 'Correlation' is selected. The 'Correlation' dialog box is displayed, showing the variables 'Productivity' and 'Experience' selected. The 'Display p-values' checkbox is checked. The worksheet 'Worksheet 1' contains data for Productivity (C1) and Experience (C2).

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
	Productivity	Experience					Source Experience	Effort			
1	840	78				2	3	5	85		
2	730	69				2	1	10	71		
3	930	67				8	3	15	3129		
4	580	60				6	4	20	1384		
5	710	69				5	5	25	875		
6	560	52				8	3	30	3159		
7	820	63				5	1	35	823		
8	880	84				3	2	40	254		
9	900	72				2	2	45	150		

Correlations: Productivity, Experience

Pearson correlation of Productivity and Experience = 0.871
P-Value = 0.000

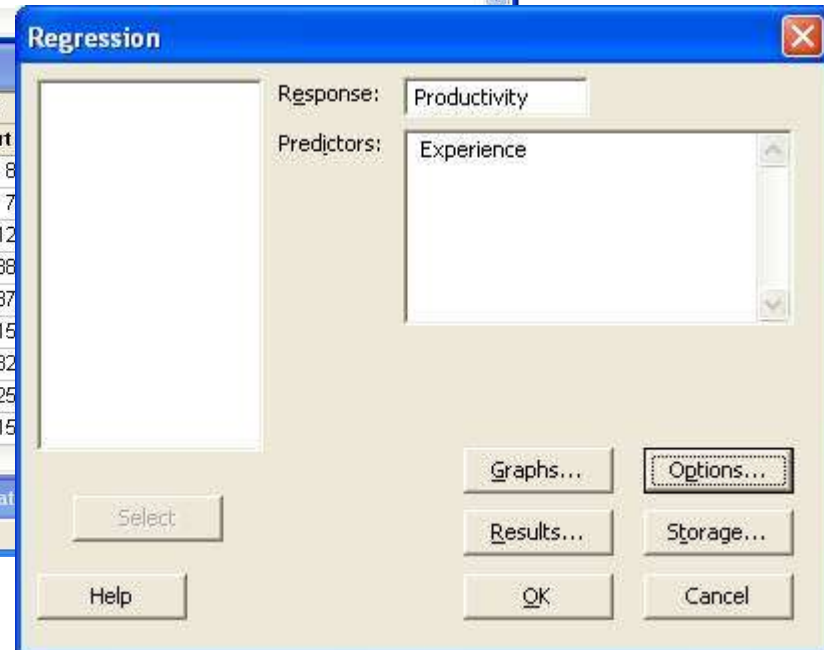
Regression Analysis



Worksheet 1 ***

	C1	C2	C3	C4	C5	C6	C7	C8
	Productivity	Experience			Code Length	Defect Count	Resource Experience	Effort
1	840	78			2	3	5	8
2	730	69			2	1	10	7
3	930	67			8	3	15	312
4	580	60			6	4	20	138
5	710	69			5	5	25	87
6	560	52			8	3	30	315
7	820	63			5	1	35	82
8	880	84			3	2	40	25
9	900	72			2	2	45	15

Perform regression using least squares estimation



Regression Analysis

Regression Analysis: Productivity versus Experience

The regression equation is

$$\text{Productivity} = -9.7 + 11.5 \text{ Experience}$$

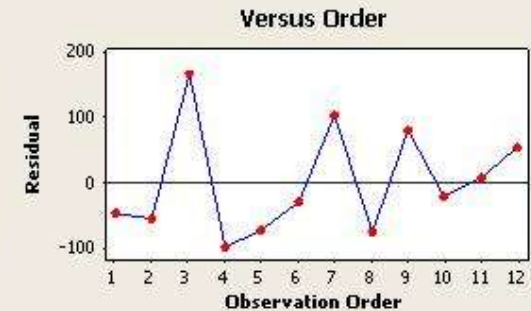
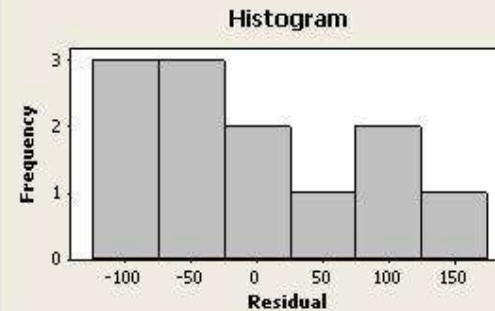
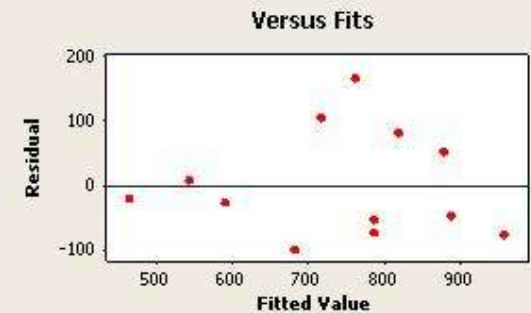
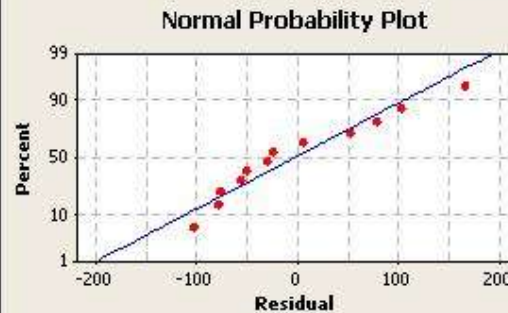
Predictor	Coef	SE Coef	T	P
Constant	-9.7	136.1	-0.07	0.945
Experience	11.520	2.057	5.60	0.000

S = 87.7955 **R-Sq = 75.8%** R-Sq(adj) = 73.4%

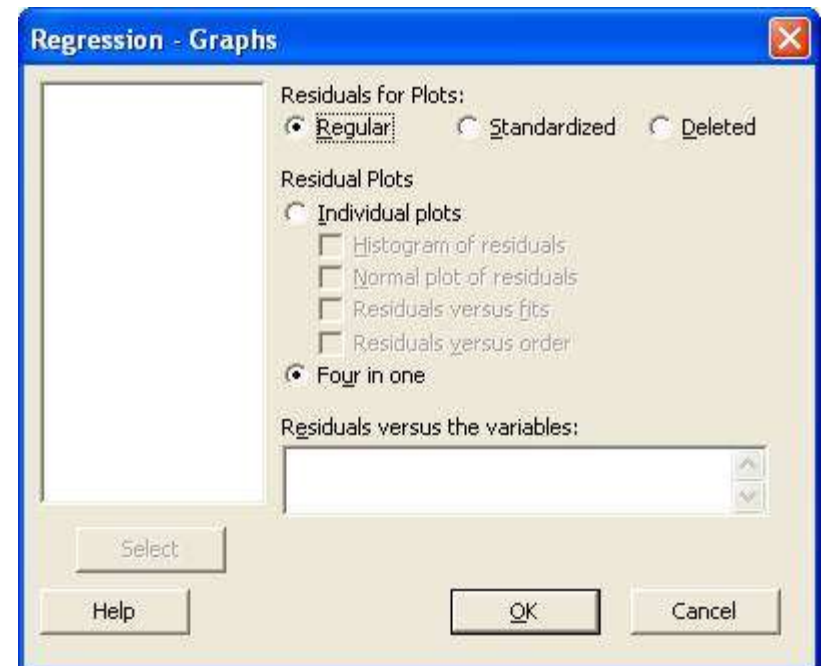
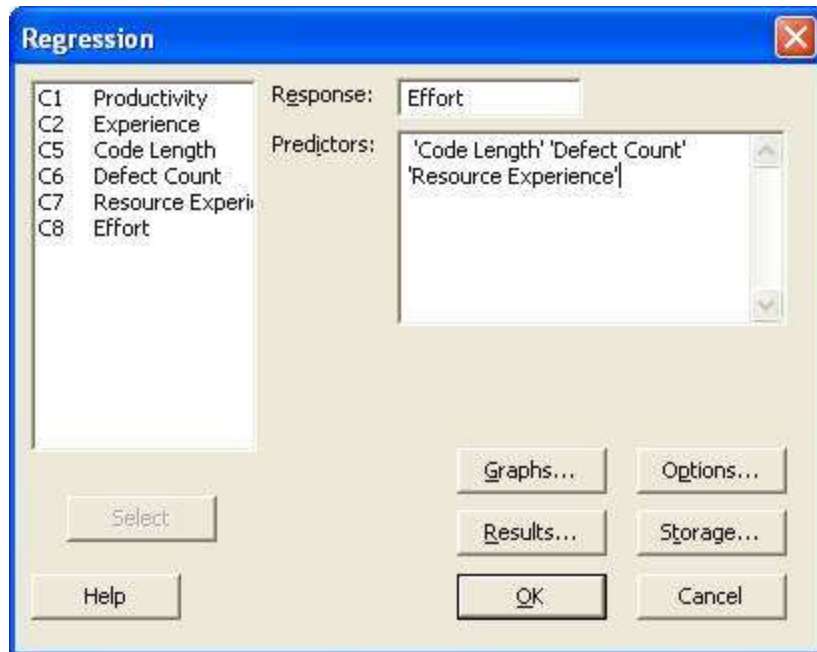
Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	241811	241811	31.37	0.000
Residual Error	10	77080	7708		
Total	11	318892			

Residual Plots for Productivity



Regression Analysis



Regression Analysis

Regression Analysis: Effort versus Code Length, Defect Count, ...

The regression equation is

Effort = - 1277 + 458 Code Length + 136 Defect Count - 1.54 Resource Experience

Predictor	Coef	SE Coef	T	P
Constant	-1277.3	360.6	-3.54	0.003
Code Length	457.70	47.64	9.61	0.000
Defect Count	135.72	61.28	2.21	0.042
Resource Experience	-1.544	4.579	-0.34	0.740

S = 487.537 R-Sq = 86.9% R-Sq(adj) = 84.5%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	25308562	8436187	35.49	0.000
Residual Error	16	3803071	237692		
Total	19	29111633			

Source	DF	Seq SS
Code Length	1	23966672
Defect Count	1	1314871
Resource Experience	1	27018

Unusual Observations

Obs	Code Length	Effort	Fit	SE Fit	Residual	St Resid
11	9.00	4631	3707	308	924	2.44R

R denotes an observation with a large standardized residual.

Minitab 15 : Hypothesis Testing

Topics

- 1-Sample-Z
- 1-Sample-T
- 2-Sample-T
- Paired T
- F-Test
- Chi-square

1 Sample Z

Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help

Basic Statistics
Regression
ANOVA
DOE
Control Charts
Quality Tools
Reliability/Survival
Multivariate
Time Series
Tables
Nonparametrics
EDA
Power and Sample Size

Display Descriptive Statistics...
Store Descriptive Statistics...
Graphical Summary...
12 1-Sample Z...
1t 1-Sample t...
2t 2-Sample t...
t-t Paired t...
1P 1 Proportion...
2P 2 Proportions...
s²p 1-Sample Poisson Rate...
s²p 2-Sample Poisson Rate...
σ² 1 Variance...
σ² 2 Variances...
COR Correlation...
COV Covariance...
Normality Test...
X² Goodness-of-Fit Test for Poisson...

Session

2/10/20

1 SAMPLE.MTW ***

	C1	C2	C3	C4	C5	C6	C7	C8
	Contracts past 6 months		Daily					
1	189000			338				
2	449000			355				
3	295300			300				
4	75000			336				
5	385400			351				
6	431300			334				
7	52000			306				
8	690000			298				
9	591000			329				

Project...

Perform one-sample Z-tests and compute confidence intervals for the means

1-Sample Z (Test and Confidence Interval)

☒ Samples in columns:
'Daily Call volume past month'

☐ Summarized data
Sample size:
Mean:

Standard deviation:

☒ Perform hypothesis test
Hypothesized mean:

Select

Help

Graphs...

Options...

OK

Cancel

1 Sample Z

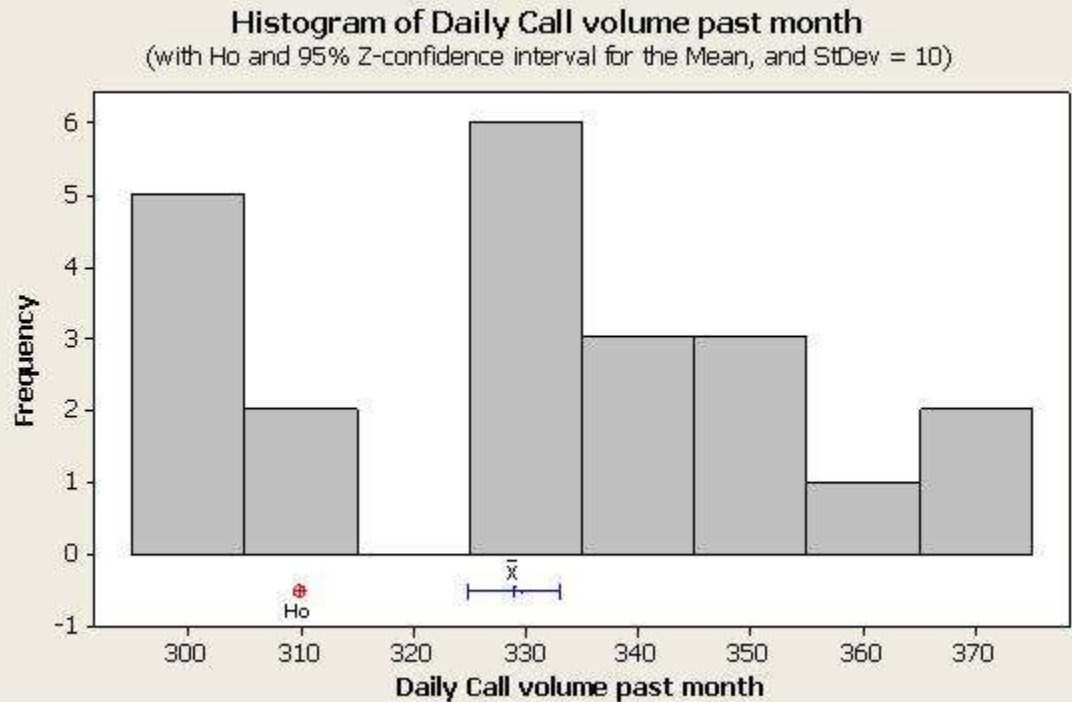
One-Sample Z: Daily Call volume past month

Test of $\mu = 310$ vs not = 310

The assumed standard deviation = 10

Variable	N	Mean	StDev	SE Mean	95% CI	Z
Daily Call volume past m	22	329.05	22.91	2.13	(324.87, 333.22)	8.93

Variable	P
Daily Call volume past m	0.000



1 Sample T

The screenshot shows the Minitab software interface. The 'Stat' menu is open, and the path 'Basic Statistics' > '1-Sample t...' is highlighted. The data table below shows 'Contracts past 6 months' in column C1 and 'Daily' in column C2. The 'Project...' dialog box is also visible at the bottom.

	C1	C2	C5	C6	C7
	Contracts past 6 months	Daily			
1	189000		338		
2	449000		355		
3	295300		300		
4	75000		336		
5	385400		351		
6	431300		334		
7	52000		306		
8	690000		298		
9	591000		329		

Project...
Perform one-sample t-tests and compute confidence intervals for the means

The dialog box '1-Sample t (Test and Confidence Interval)' is shown. It has two radio buttons: 'Samples in columns:' (selected) and 'Summarized data'. The 'Samples in columns:' section has a text box containing 'Daily Call volume past month'. The 'Summarized data' section has input boxes for 'Sample size:', 'Mean:', and 'Standard deviation:'. The 'Perform hypothesis test' checkbox is checked, and the 'Hypothesized mean:' is set to 325. At the bottom, there are buttons for 'Select', 'Help', 'Graphs...', 'Options...', 'OK', and 'Cancel'.

1-Sample t (Test and Confidence Interval)

☒ Samples in columns:
'Daily Call volume past month'

☐ Summarized data
Sample size:
Mean:
Standard deviation:

☒ Perform hypothesis test
Hypothesized mean: 325

Select Help Graphs... Options... OK Cancel

1 Sample T

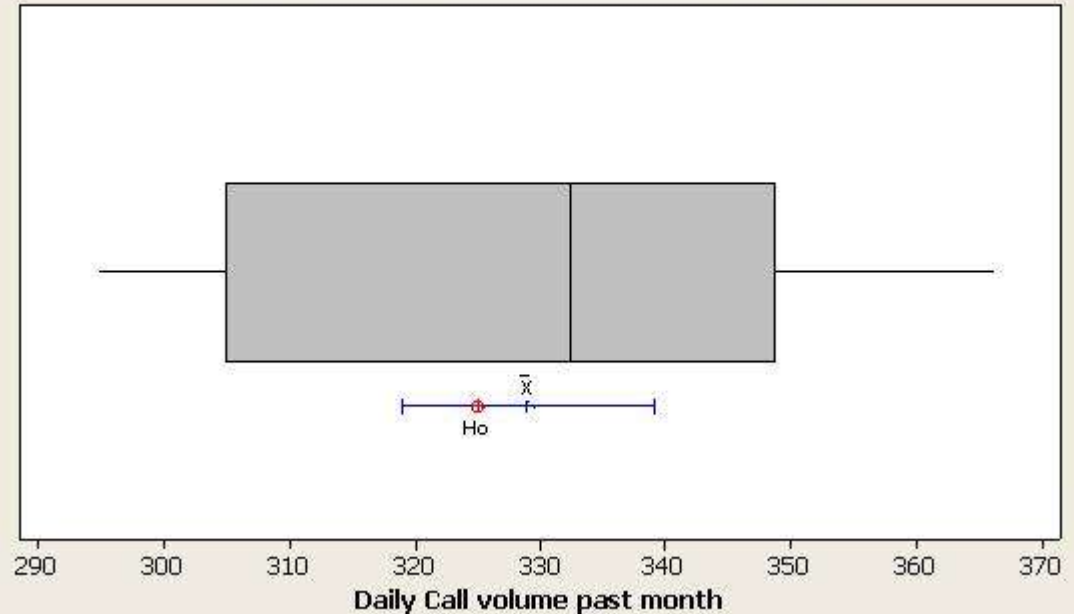
One-Sample T: Daily Call volume past month

Test of $\mu = 325$ vs not $= 325$

Variable	N	Mean	StDev	SE Mean	95% CI	T
Daily Call volume past m	22	329.05	22.91	4.88	(318.89, 339.20)	0.83

Variable	P
Daily Call volume past m	0.417

Boxplot of Daily Call volume past month
(with Ho and 95% t-confidence interval for the mean)



2 Sample T

The screenshot displays the Minitab software interface. The 'Stat' menu is open, showing the '2-Sample t...' option selected. The '2-Sample t (Test and Confidence Interval)' dialog box is open, showing the 'Samples in different columns' option selected. The 'First' sample is identified as ',000 Old Method' and the 'Second' sample as '000 New Method'. The 'Assume equal variances' checkbox is checked. The '2 SAMPLE.MTW' data table is visible in the background, showing data for 'East Coast Monthly' and 'West Coast Monthly' defects per 10,000 new methods.

2-Sample t (Test and Confidence Interval) Dialog Box:

- ☐ Samples in one column
- ☒ Samples in different columns
 - First: ,000 Old Method
 - Second: 000 New Method
- ☐ Summarized data
 - First: Sample size: Mean: Standard deviation:
 - Second: Sample size: Mean: Standard deviation:
- ☒ Assume equal variances

2 SAMPLE.MTW Data Table:

	C1 East Coast Monthly	C2 West Coast Monthly	C5 Defects/10,000 New
1	13000000	20180000	206
2	12800000	16300000	256
3	13400000	20090000	225
4	11800000	14100000	250
5	14100000	12000000	260
6	13100000	14300000	230
7	12600000	10500000	262
8	12900000	16100000	248
9	12900000	12000000	290

Project...

Perform two-sample t-tests and compute confidence intervals for the difference in means

2 Sample T

Two-Sample T-Test and CI: Defects/10,000 Old Method, Defects/10,000 New Method

Two-sample T for Defects/10,000 Old Method vs Defects/10,000 New Method

	N	Mean	StDev	SE Mean
Defects/10,000 Old Metho	35	252.9	18.7	3.2
Defects/10,000 New Metho	20	225.5	14.8	3.3

Difference = μ (Defects/10,000 Old Method) - μ (Defects/10,000 New Method)

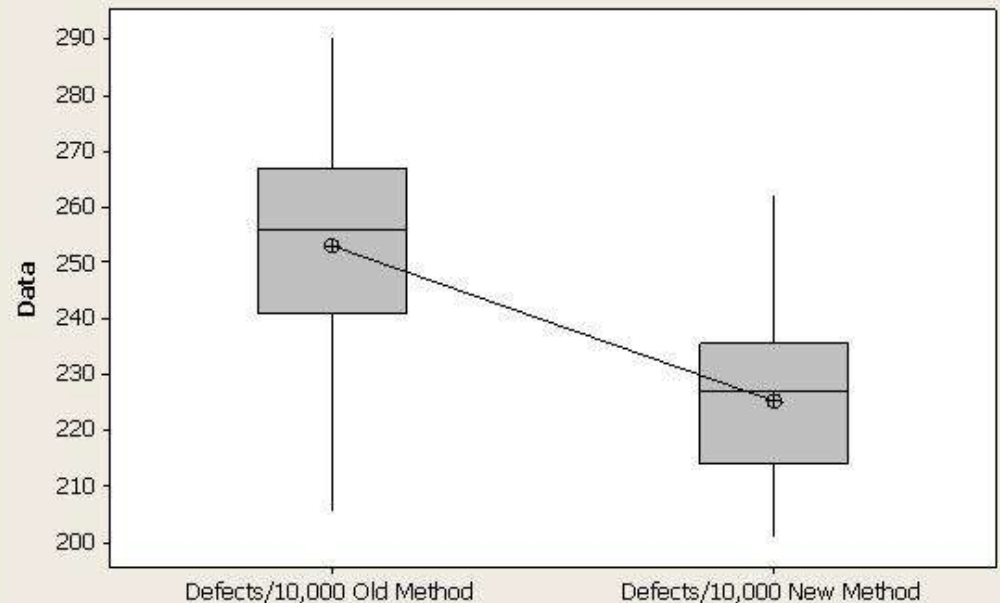
Estimate for difference: 27.44

95% CI for difference: (17.66, 37.22)

T-Test of difference = 0 (vs not =): T-Value = 5.63 P-Value = 0.000 DF = 53

Both use Pooled StDev = 17.3927

Boxplot of Defects/ 10,000 Old Method, Defects/ 10,000 New Method



Paired T

The screenshot shows the Minitab 2 SAMPLE.MTW window. The 'Stat' menu is open, and 'Paired t...' is selected under the 't' submenu. The main window displays a table with 9 rows of data. The first column is labeled 'Defects/10,000 New Method'. The second column contains values ranging from 216 to 237. The third column contains values ranging from 70.0 to 81.29. The fourth column contains values ranging from 70.3 to 80.1.

	C5	C6	C10	C11	C12	C13	C14
1	229		81.29	75.6			
2	237		86.56	73.2			
3	230		86.20	71.1			
4	219		85.33	75.3			
5	225		80.95	70.3			
6	201		87.76	75.0			
7	235		88.45	79.1			
8	221		81.25	70.0			
9	216		89.10	80.1			

Paired t (Test and Confidence Interval)

☒ Samples in columns

First sample: 'Weight - Before'

Second sample: 'Weight - After'

☐ Summarized data (differences)

Sample size:

Mean:

Standard deviation:

Paired t evaluates the first sample minus the second sample.

Select

Graphs...

Options...

Help

OK

Cancel

Paired T

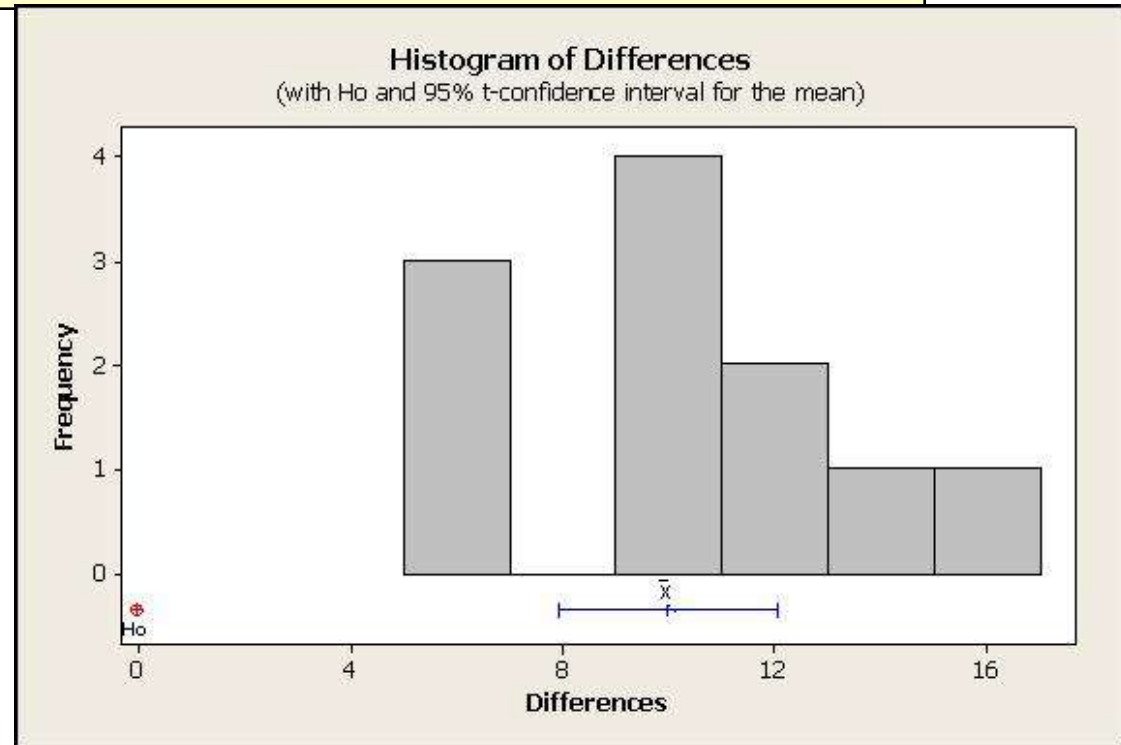
Paired T-Test and CI: Weight - Before, Weight - After

Paired T for Weight - Before - Weight - After

	N	Mean	StDev	SE Mean
Weight - Before	11	85.14	3.32	1.00
Weight - After	11	75.13	4.01	1.21
Difference	11	10.008	3.037	0.916

95% CI for mean difference: (7.968, 12.048)

T-Test of mean difference = 0 (vs not = 0): T-Value = 10.93 P-Value = 0.000



F Test

Minitab - 2 SAMPLE.MTW

File Edit Data Calc Stat Graph Editor Tools Window Help

Basic Statistics
Regression
ANOVA
DOE
Control Charts
Quality Tools
Reliability/Survival
Multivariate
Time Series
Tables
Nonparametrics
EDA
Power and Sample Size

Display Descriptive Statistics...
Store Descriptive Statistics...
Graphical Summary...
1Z 1-Sample Z...
1t 1-Sample t...
2t 2-Sample t...
t-t Paired t...
1P 1 Proportion...
2P 2 Proportions...
1sP 1-Sample Poisson Rate...
2sP 2-Sample Poisson Rate...
σ² 1 Variance...
σ² 2 Variances...
COR Correlation...
COV Covariance...
Normality Test...
X² Goodness-of-Fit Test for Poisson...

2 SAMPLE.MTW ***

	C1 East Coast Monthly	C2 West Coast Monthly	C3 East Coast Monthly	C4 West Coast Monthly	C5 Defects/10,000 New Method
1	13000000	20180000			229
2	12800000	16300000			237
3	13400000	20090000			230
4	11800000	14100000			219
5	14100000	12000000			225
6	13100000	14300000			201
7	12600000	10500000			235
8	12900000	16100000			221
9	12900000	12000000			216

2 Variances

☐ Samples in one column
Samples:
Subscripts:

☒ Samples in different columns
First:
Second:

☐ Summarized data
Sample size: Variance:
First: Second:

Select

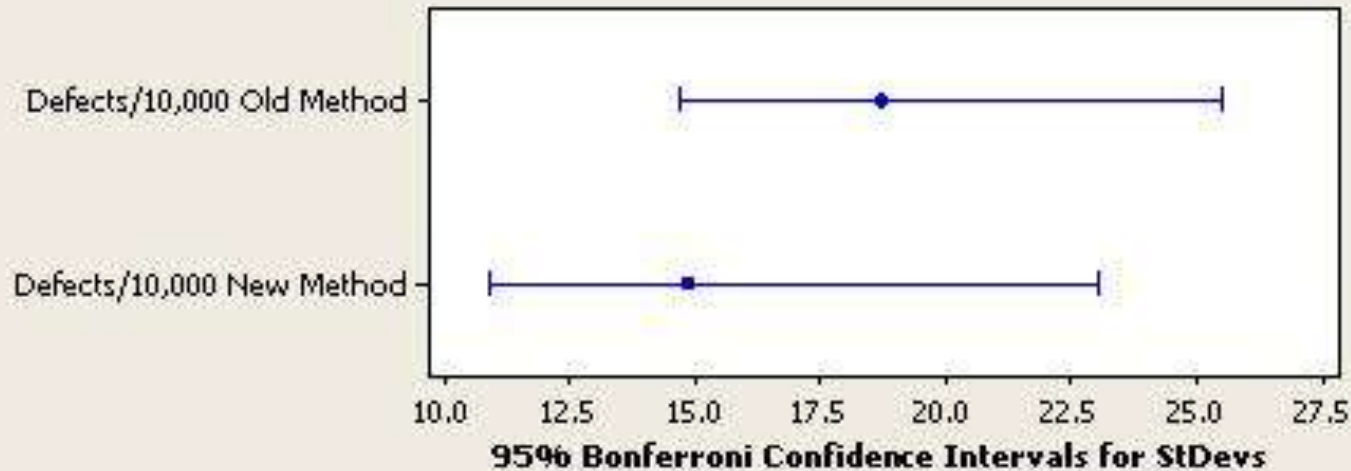
Options... Storage...

Help OK Cancel

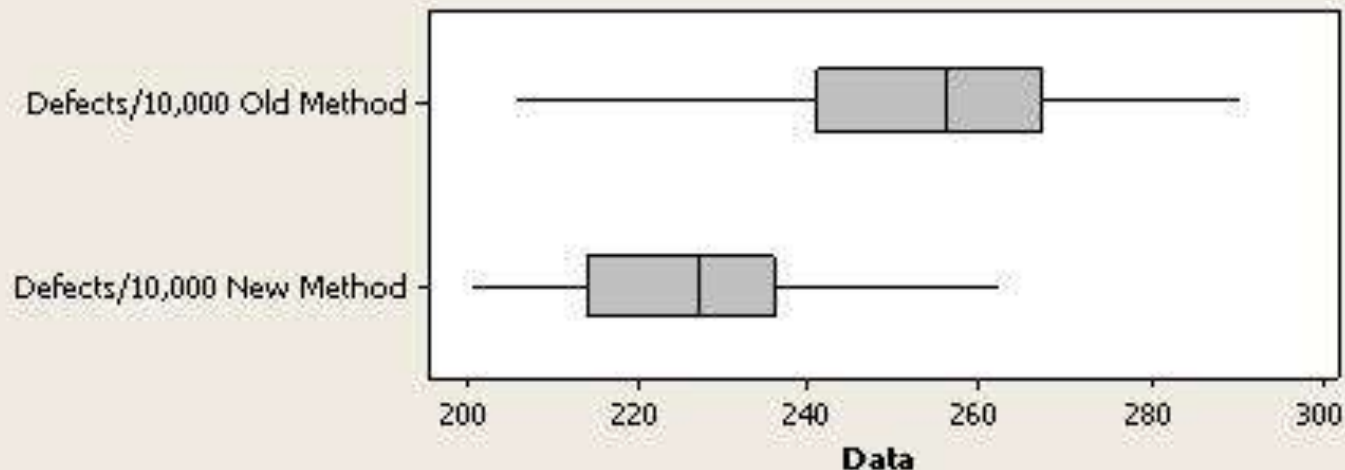
Perform equality of variance tests

F Test

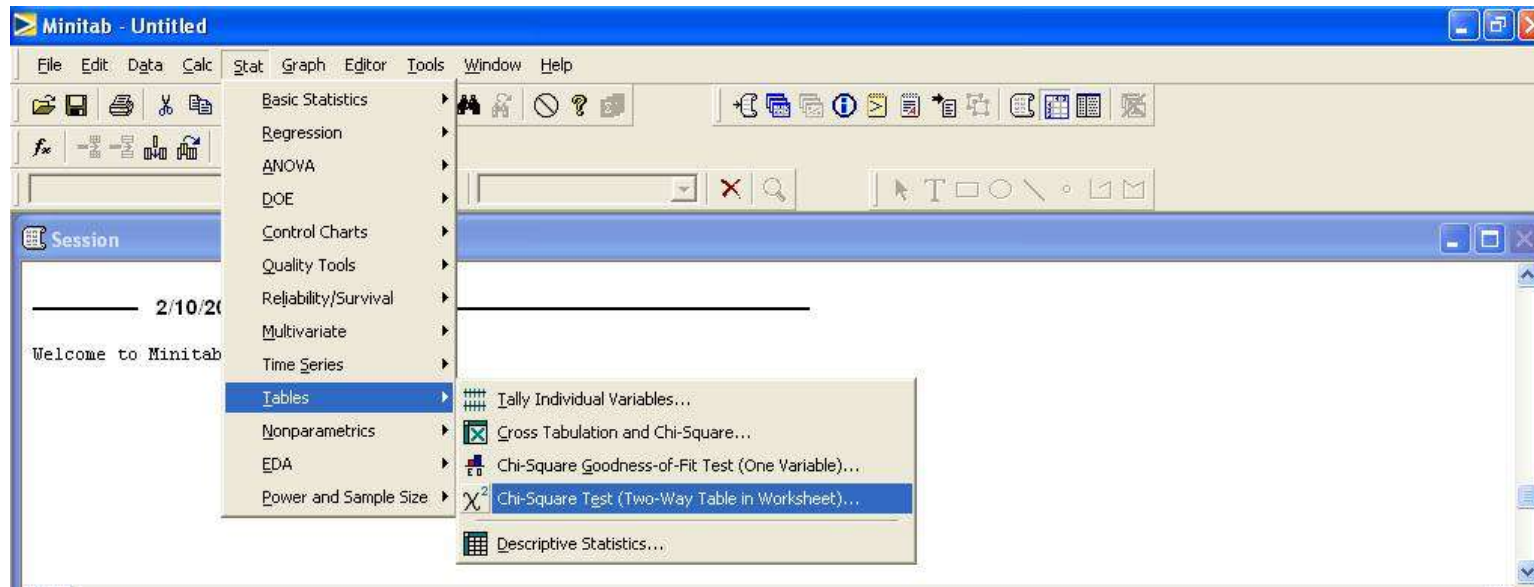
Test for Equal Variances for Defects/ 10,000 Old Method, Defects/ 10,000 New Method



F-Test	
Test Statistic	1.58
P-Value	0.292
Levene's Test	
Test Statistic	1.04
P-Value	0.311



Chi-square



Worksheet 1 ***

	C1-T	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
		England	Australia	Pakistan	Srilanka							
1	Win	72	82	130	95							
2	Loss	125	140	180	45							
3												
4												
5												
6												
7												
8												
9												

Project...

Perform tests for association (nonindependence) in two-way contingency tables



Chi-square

Chi-Square Test: England, Australia, Pakistan, Srilanka

Expected counts are printed below observed counts

Chi-Square contributions are printed below expected counts

	England	Australia	Pakistan	Srilanka	Total
1	72	82	130	95	379
	85.92	96.82	135.20	61.06	
	2.255	2.269	0.200	18.867	
2	125	140	180	45	490
	111.08	125.18	174.80	78.94	
	1.744	1.755	0.155	14.593	
Total	197	222	310	140	869

Chi-Sq = 41.838, DF = 3, **P-Value = 0.000**

Thank You