

```

OMSEND.
45  0 M>  OMSSEND.

46  0 M>
BEGIN PROGRAM Python3.
47  0 M>  BEGIN PROGRAM Python3.
import os, csv, math
import spss

BASE = r"D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test"
DATA = os.path.join(BASE, "dataset.csv")
if not os.path.exists(DATA):
    for alt in ("dataset", "dataset.txt"):
        p = os.path.join(BASE, alt)
        if os.path.exists(p):
            DATA = p
            break
if not os.path.exists(DATA):
    raise RuntimeError("dataset.csv was not found in the Brunner Munzel Test folder.")

OUT = os.path.join(BASE, "SPSS_Output")
SAV = os.path.join(OUT, "sav")
SPV = os.path.join(OUT, "spv")
PDF = os.path.join(OUT, "pdf")
for p in (OUT, SAV, SPV, PDF):
    if not os.path.exists(p):
        os.makedirs(p)

for folder, ext in ((SAV, ".sav"), (SPV, ".spv"), (PDF, ".pdf")):
    for name in os.listdir(folder):
        if name.lower().endswith(ext):
            try: os.remove(os.path.join(folder, name))
            except: pass

def detect_delimiter(path):
    sample = open(path, "r", encoding="utf-8-sig", errors="replace").read(4096)
    counts = {",": sample.count(","), ";": sample.count(";"), "\t": sample.count("\t")}
    return max(counts, key=counts.get)

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delim = detect_delimiter(DATA)
with open(DATA, "r", encoding="utf-8-sig", errors="replace", newline="") as f:
    rows = list(csv.DictReader(f, delimiter=delim))
if not rows:
    raise RuntimeError("The CSV file contains no data rows.")

headers = [h.strip() for h in rows[0].keys() if h is not None]

def clean(v):
    return "" if v is None else str(v).strip()

def as_float(v):
    try:
        x = float(clean(v))
        return x if math.isfinite(x) else None
    except:
        return None

preferred_groups = ["group", "Group", "treatment", "Treatment", "sex", "school", "condition", "category"]
group = None
for h in preferred_groups + headers:
    if h not in headers: continue
    vals = [clean(r.get(h)) for r in rows if clean(r.get(h)) != ""]
    levels = sorted(set(vals))
    if len(levels) == 2 and min(vals.count(levels[0]), vals.count(levels[1]))
    >= 3:
        group = h
        break
if group is None:
    raise RuntimeError("No grouping variable with exactly two usable levels was found.")

preferred_outcomes = ["outcome", "Outcome", "score", "Score", "value", "Value", "G3", "G2", "G1"]
outcome = None
for h in preferred_outcomes + headers:
    if h == group or h not in headers: continue
    vals = [as_float(r.get(h)) for r in rows]
    vals = [v for v in vals if v is not None]
    if len(vals) >= 6 and len(set(vals)) >= 2:
        outcome = h

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        break
    if outcome is None:
        raise RuntimeError("No usable numeric outcome variable was found.")

clean_rows = []
for r in rows:
    g = clean(r.get(group))
    v = as_float(r.get(outcome))
    if g != "" and v is not None:
        clean_rows.append((g, v))
levels = sorted(set(g for g,v in clean_rows))
if len(levels) != 2:
    raise RuntimeError("The selected group does not have exactly two levels after cleaning.")
x = [v for g,v in clean_rows if g == levels[0]]
y = [v for g,v in clean_rows if g == levels[1]]
if min(len(x), len(y)) < 3:
    raise RuntimeError("Each group must contain at least three valid observations.")

def midranks(values):
    order = sorted(range(len(values)), key=lambda i: values[i])
    ranks = [0.0]*len(values)
    i = 0
    while i < len(order):
        j = i
        while j+1 < len(order) and values[order[j+1]] == values[order[i]]:
            j += 1
        rank = ((i+1)+(j+1))/2.0
        for k in range(i,j+1): ranks[order[k]] = rank
        i = j+1
    return ranks

def mean(a): return sum(a)/len(a)
def sample_var(a):
    m=mean(a)
    return sum((v-m)**2 for v in a)/(len(a)-1)

n1,n2=len(x),len(y)
rp=midranks(x+y)
rx=rp[:n1]; ry=rp[n1:]
wx=midranks(x); wy=midranks(y)

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dx=[rx[i]-wx[i] for i in range(n1)]
dy=[ry[i]-wy[i] for i in range(n2)]
sx2=sample_var(dx); sy2=sample_var(dy)
den2=n1*sx2+n2*sy2
if den2 <= 0:
    raise RuntimeError("Brunner-Munzel variance estimate is zero or undefined.
")
w=n1*n2*(mean(ry)-mean(rx))/((n1+n2)*math.sqrt(den2))
df=(den2**2)/(((n1*sx2)**2/(n1-1))+((n2*sy2)**2/(n2-1)))

# Normal approximation is used for the displayed SPSS p-value because
# the standard library has no Student-t CDF.
p=math.erfc(abs(w)/math.sqrt(2.0))
less=sum(1 for a in x for b in y if a<b)
ties=sum(1 for a in x for b in y if a==b)
prob=(less+0.5*ties)/(n1*n2)

safe_group = "bm_group"
safe_value = "bm_value"
tmp = os.path.join(OUT, "brunner_munzel_prepared.csv")
with open(tmp, "w", newline="", encoding="utf-8") as f:
    wr=csv.writer(f)
    wr.writerow([safe_group, safe_value])
    for g,v in clean_rows:
        wr.writerow([1 if g==levels[0] else 2, v])

spss.Submit(r"""
GET DATA
  /TYPE=TXT
  /FILE='%s'
  /ENCODING='UTF8'
  /DELCASE=LINE
  /DELIMITERS=", "
  /ARRANGEMENT=DELIMITED
  /FIRSTCASE=2
  /IMPORTCASE=ALL
  /VARIABLES=
    bm_group F1.0
    bm_value F20.8.
DATASET NAME BrunnerMunzelData.
VARIABLE LABELS
  bm_group 'Detected two-level grouping variable'

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bm_value 'Detected numeric outcome variable'.
VALUE LABELS bm_group
  1 '%(lev1)s'
  2 '%(lev2)s'.
FORMATS bm_value (F12.4).
EXECUTE.

SAVE OUTFILE='%(savfile)s'
/COMPRESSED.

TITLE 'Brunner-Munzel Test'.
SUBTITLE 'Prepared data and descriptive output'.

FREQUENCIES VARIABLES=bm_group
/ORDER=ANALYSIS.

EXAMINE VARIABLES=bm_value BY bm_group
/PLOT=BOXPLOT HISTOGRAM
/COMPARE GROUPS
/STATISTICS=DESCRIPTIVES
/CINTERVAL 95
/MISSING=LISTWISE
/NOTOTAL.

NPAR TESTS
/M-W=bm_value BY bm_group(1 2)
/MISSING ANALYSIS.

NEW FILE.
DATASET NAME BrunnerMunzelResults.
DATA LIST LIST /
  W_Statistic (F16.8)
  Approx_DF (F16.8)
  Approx_P_TwoSided (F16.8)
  Probability_Superiority (F16.8)
  N_Group1 (F8.0)
  N_Group2 (F8.0).
BEGIN DATA
%(w).8f %(df).8f %(p).8f %(prob).8f %(n1)d %(n2)d
END DATA.
VARIABLE LABELS
  W_Statistic 'Brunner-Munzel W statistic'

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Approx_DF 'Brunner-Munzel approximate degrees of freedom'
Approx_P_TwoSided 'Two-sided normal-approximation p value'
Probability_Superiority 'P(X<Y)+0.5P(X=Y)'.
FORMATS ALL (F12.6).
TITLE 'Brunner-Munzel Test Results'.
LIST.

OUTPUT SAVE OUTFILE='% (spvfile)s'.
OUTPUT EXPORT
  /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRINTSETTING
  /PDF DOCUMENTFILE='% (pdffile)s'.
""" % {
"tmp": tmp.replace("\\", "/"),
"lev1": levels[0].replace("'", '"')[:60],
"lev2": levels[1].replace("'", '"')[:60],
"savfile": os.path.join(SAV, "brunner_munzel_prepared_data.sav").replace("\\", "/"),
"spvfile": os.path.join(SPV, "brunner_munzel_spss_output.spv").replace("\\", "/"),
"pdffile": os.path.join(PDF, "brunner_munzel_spss_output.pdf").replace("\\", "/"),
"w": w, "df": df, "p": p, "prob": prob, "n1": n1, "n2": n2
})
END PROGRAM.
262 0 M> GET DATA
263 0 M> /TYPE=TXT
264 0 M> /FILE='D:/DATA ANALYSIS/J Nonparametric Tests/Brunner Munzel Test
/SPSS_Output/brunner_munzel_prepared.csv'
265 0 M> /ENCODING='UTF8'
266 0 M> /DELCASE=LINE
267 0 M> /DELIMITERS=", "
268 0 M> /ARRANGEMENT=DELIMITED
269 0 M> /FIRSTCASE=2
270 0 M> /IMPORTCASE=ALL
271 0 M> /VARIABLES=
272 0 M> bm_group F1.0
273 0 M> bm_value F20.8.
274 0 M> DATASET NAME BrunnerMunzelData.
275 0 M> VARIABLE LABELS
276 0 M> bm_group 'Detected two-level grouping variable'
277 0 M> bm_value 'Detected numeric outcome variable'.
278 0 M> VALUE LABELS bm_group

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279 0 M> 1 'F'
280 0 M> 2 'M'.
281 0 M> FORMATS bm_value (F12.4).
282 0 M> EXECUTE.
283 0 M> SAVE OUTFILE='D:/DATA ANALYSIS/J Nonparametric Tests/Brunner Munze
1 Test/SPSS_Output/sav/brunner_munzel_prepared_data.sa
      v'
284 0 M> /COMPRESSED.
285 0 M> TITLE 'Brunner-Munzel Test'.
```

Brunner-Munzel Test

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286 0 M> SUBTITLE 'Prepared data and descriptive output'.
```

Brunner-Munzel Test
Prepared data and descriptive output

```
287  0 M>  FREQUENCIES VARIABLES=bm_group
288  0 M>    /ORDER=ANALYSIS.
```

Frequencies

Notes

Output Created		16-JUL-2026 11:44:42
Comments		
Input	Data	D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\sav\brunner_munzel_prepared_data.sav
	Active Dataset	BrunnerMunzelData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=bm_group /ORDER=ANALYSIS.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01

[BrunnerMunzelData] D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\sav\brunner_munzel_prepared_data.sav

Statistics

Detected two-level grouping variable

N	Valid	649
	Missing	0

Brunner-Munzel Test
Prepared data and descriptive output

Detected two-level grouping variable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	383	59.0	59.0	59.0
	M	266	41.0	41.0	100.0
	Total	649	100.0	100.0	

```

289  0 M> EXAMINE VARIABLES=bm_value BY bm_group
290  0 M> /PLOT=BOXPLOT HISTOGRAM
291  0 M> /COMPARE GROUPS
292  0 M> /STATISTICS=DESCRIPTIVES
293  0 M> /CINTERVAL 95
294  0 M> /MISSING=LISTWISE
295  0 M> /NOTOTAL.

```

Explore

Notes

Output Created		16-JUL-2026 11:44:42
Comments		
Input	Data	D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\sav\br unner_munzel_prepared_ data.sav
	Active Dataset	BrunnerMunzelData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.

Brunner-Munzel Test
Prepared data and descriptive output

Notes

Syntax		EXAMINE VARIABLES=bm_value BY bm_group /PLOT=BOXPLOT HISTOGRAM /COMPARE GROUPS /STATISTICS=DESCRIPT IVES /INTERVAL 95 /MISSING=LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:07.03
	Elapsed Time	00:00:02.30

Detected two-level grouping variable

Case Processing Summary

		Cases			
		Valid		Missing	
	Detected two-level grouping variable	N	Percent	N	Percent
Detected numeric outcome variable	F	383	100.0%	0	0.0%
	M	266	100.0%	0	0.0%

Case Processing Summary

		Cases	
		Total	
	Detected two-level grouping variable	N	Percent
Detected numeric outcome variable	F	383	100.0%
	M	266	100.0%

Brunner-Munzel Test
Prepared data and descriptive output

Descriptives

Detected two-level grouping variable		Statistic	
Detected numeric outcome variable	F	Mean	12.253264
		95% Confidence Interval for Mean	Lower Bound 11.939388
			Upper Bound 12.567140
		5% Trimmed Mean	12.370902
		Median	12.000000
		Variance	9.760
		Std. Deviation	3.1241474
		Minimum	.0000
		Maximum	19.0000
		Range	19.0000
		Interquartile Range	4.0000
		Skewness	-.857
		Kurtosis	2.683
	M	Mean	11.406015
		95% Confidence Interval for Mean	Lower Bound 11.005127
			Upper Bound 11.806904
		5% Trimmed Mean	11.596074
		Median	11.000000
		Variance	11.027
		Std. Deviation	3.3206901
		Minimum	.0000
		Maximum	19.0000
		Range	19.0000
		Interquartile Range	3.0000
		Skewness	-.980
		Kurtosis	2.803

Brunner-Munzel Test
Prepared data and descriptive output

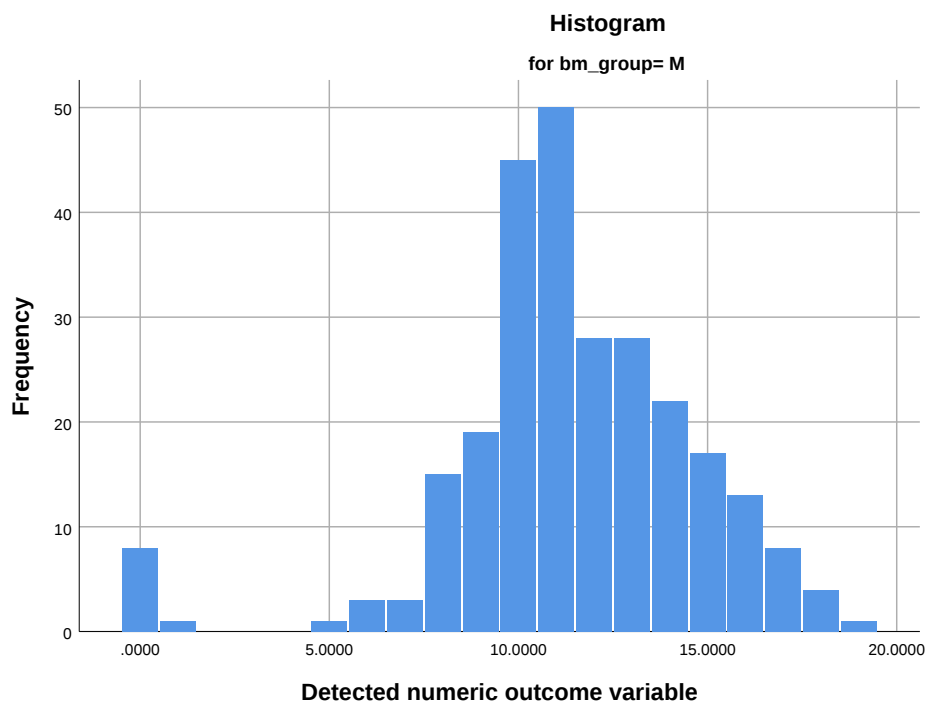
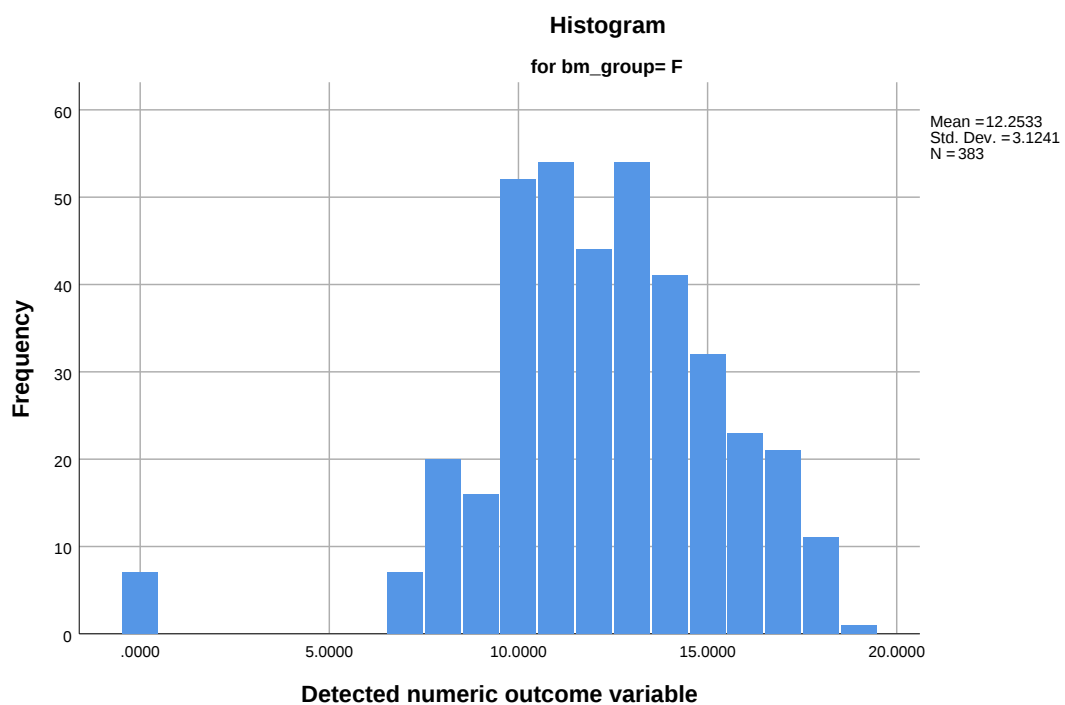
Descriptives

Detected two-level grouping variable			Std. Error
Detected numeric outcome variable	F	Mean	.1596365
		95% Confidence Interval for Mean	Lower Bound
			Upper Bound
		5% Trimmed Mean	
		Median	
		Variance	
		Std. Deviation	
		Minimum	
		Maximum	
		Range	
		Interquartile Range	
		Skewness	.125
		Kurtosis	.249
	M	Mean	.2036046
		95% Confidence Interval for Mean	Lower Bound
			Upper Bound
		5% Trimmed Mean	
		Median	
		Variance	
		Std. Deviation	
		Minimum	
		Maximum	
		Range	
		Interquartile Range	
		Skewness	.149
		Kurtosis	.298

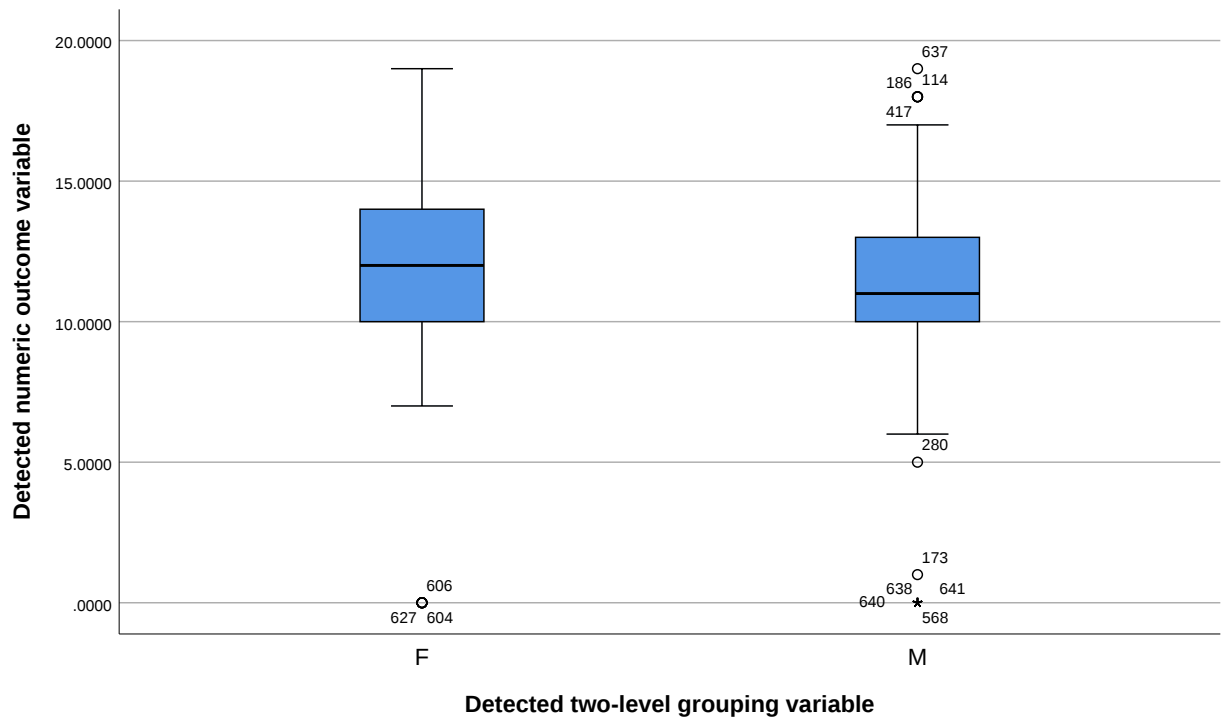
Detected numeric outcome variable

Histograms

Brunner-Munzel Test
Prepared data and descriptive output



Brunner-Munzel Test Prepared data and descriptive output



```

296  0 M>  NPAR TESTS
297  0 M>  /M-W=bm_value BY bm_group(1 2)
298  0 M>  /MISSING ANALYSIS.

```

NPar Tests

Brunner-Munzel Test
Prepared data and descriptive output

Notes

Output Created		16-JUL-2026 11:44:45
Comments		
Input	Data	D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\sav\br unner_munzel_prepared_ data.sav
	Active Dataset	BrunnerMunzelData
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	649
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable (s) used in that test.
Syntax		NPAR TESTS /M-W=bm_value BY bm_group(1 2) /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.01
	Number of Cases Allowed ^a	449389

a. Based on availability of workspace memory.

Mann-Whitney Test

Brunner-Munzel Test
Prepared data and descriptive output

Ranks

	Detected two-level grouping variable	N	Mean Rank	Sum of Ranks
Detected numeric outcome variable	F	383	345.83	132452.50
	M	266	295.01	78472.50
	Total	649		

Test Statistics^a

	Detected numeric outcome variable
Mann-Whitney U	42961.500
Wilcoxon W	78472.500
Z	-3.418
Asymp. Sig. (2-tailed)	.001

a. Grouping Variable: Detected two-level grouping variable

```

299  0 M> NEW FILE.
300  0 M> DATASET NAME BrunnerMunzelResults.
301  0 M> DATA LIST LIST /
302  0 M>   W_Statistic (F16.8)
303  0 M>   Approx_DF (F16.8)
304  0 M>   Approx_P_TwoSided (F16.8)
305  0 M>   Probability_Superiority (F16.8)
306  0 M>   N_Group1 (F8.0)
307  0 M>   N_Group2 (F8.0).
308  0 M> BEGIN DATA
309  0 M> VARIABLE LABELS
310  0 M>   W_Statistic 'Brunner-Munzel W statistic'
311  0 M>   Approx_DF 'Brunner-Munzel approximate degrees of freedom'
312  0 M>   Approx_P_TwoSided 'Two-sided normal-approximation p value'
313  0 M>   Probability_Superiority 'P(X<Y)+0.5P(X=Y)'.
314  0 M> FORMATS ALL (F12.6).
315  0 M> TITLE 'Brunner-Munzel Test Results'.

```

Brunner-Munzel Test Results

316 0 M> LIST.

List

Notes

Output Created		16-JUL-2026 11:44:45
Comments		
Input	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	1
Syntax		LIST.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

Brunner-Munzel Test Results

W_Statistic p1	N_Group2	Approx_DF	Approx_P_TwoSided	Probability_Superiority	N_Group
-3.468824	575.612839		.000523	.421696	383.0000
00	266.000000				

Number of cases read: 1 Number of cases listed: 1

```
317  0 M> OUTPUT SAVE OUTFILE='D:/DATA ANALYSIS/J Nonparametric Tests/Brunner
r Munzel Test/SPSS_Output/spv/brunner_munzel_spss_outp
      ut.spv'.
318  0 M> OUTPUT EXPORT
319  0 M> /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRINTSETTING
320  0 M> /PDF DOCUMENTFILE='D:/DATA ANALYSIS/J Nonparametric Tests/Brunner
Munzel Test/SPSS_Output/pdf/brunner_munzel_spss_outpu
      t.pdf'.
```

Output Export

Brunner-Munzel Test Results

Notes

Output Created		16-JUL-2026 11:44:46
Comments		
Input	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	1
Syntax		OUTPUT EXPORT /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRINTSE TTING /PDF DOCUMENTFILE='D: /DATA ANALYSIS/J Nonparametric Tests/Brunner Munzel Test/SPSS_Output/pdf/bru nner_munzel_spss_output .pdf'.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:10.26
Files Saved	Viewer	Document2
	Document File	D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\pdf\bru nner_munzel_spss_output .pdf
	Image File Count	0

Export Summary

Viewer	Document2
Document File	D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\pdf\brunner_ munzel_spss_output.pdf

```

321  0 M> .
322  0 M> BEGIN PROGRAM '#

```

Brunner-Munzel Test Results

'.

323 0 M>

OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\spv\brunner_munzel_spss_output.spv'.

324 0 M> OUTPUT SAVE OUTFILE='D:\DATA ANALYSIS\J Nonparametric Tests\Brunner Munzel Test\SPSS_Output\spv\brunner_munzel_spss_output.spv'.

OUTPUT EXPORT

325 0 M> OUTPUT EXPORT

/CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRINTSETTING

326 0 M> /CONTENTS EXPORT=ALL LAYERS=PRINTSETTING MODELVIEWS=PRINTSETTING