Understanding Statistics and Experimental Design

Exercise about non-parametric test

Exercise 1

WilcoxonSignedRanks

D =
-13
2
-7
-23
2
-5
-2
-11
3
-8

Step 1: State the hypotheses, and select an alpha.

H0: There is no systematic difference before and after the treatment

H1: There is a consistent difference between the measurements before and after the treatment that causes the scores before the treatment to be generally higher than the scores after.

We will use alpha = 0.05

Step 2: Locate the critical region.

A small value for the Wilcoxon T indicates that the difference scores were consistently positive or consistently negative, which indicates a systematic treatment difference. Thus, small values will tend to refute H0. With n = 10 and alpha = 0.05, the Wilcoxon table shows that a T value of 8 or smaller is needed to reject H0.

Step 3: Compute the test statistic.

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a. Ignoring the signs (+ or -), rank the difference scores from smallest to largest.

Rank =

9.0
2.0
6.0
10.0
2.0
5.0
2.0
8.0
4.0
7.0

b. Compute the sum of the ranks for the positive differences and the sum for the negative differences.

Sum(R-) = sum([9 6 10 5 2 8 7]) = 47

Sum(R+) = sum([2 2 4]) = 8

c. The Wilcoxon T is the smaller of the two sums.

T = min(Sum(R-),Sum(R+)) = min(47,8) = 8

Step 4: Make a decision.

The obtained T value is in the critical region. These data are significantly different from chance.

Therefore, we REJECT H0 and conclude that there is sufficient evidence to suggest a systematic

difference between the two treatment conditions.

T = 8, p(N = 10, 2-tailed) = 0.048828

Wobs≤Wcritical ->reject H_0 ->sign

http://www.socscistatistics.com/tests/signedranks/Default2.aspx

Table of critical values for the Wilcoxon test:

To use this table: compare your obtained value of Wilcoxon's test statistic to the critical value in the table (taking into account N, the number of subjects). Your obtained value is statistically significant if it is equal to or SMALLER than the value in the table.

e.g.: suppose my obtained value is 22, and I had 15 participants. The critical value in the table is 25: my obtained value is *smaller* than this, and so I would conclude that the difference between the two conditions in my study was unlikely to occur by chance (p<.05 two-tailed test, or p<.025, one-tailed test).

	One Tailed Significance levels:		
	0.025	0.01	0.005
	Two Tailed significance levels:		
N	0.05	0.02	0.01
6	0	-	-
7	2	0	-
8	4	2	0
9	6	3	2
10	8	5	3
11	11	7	5
12	14	10	7
13	17	13	10
14	21	16	13
15	25	20	16
16	30	24	20
17	35	28	23
18	40	33	28
19	46	38	32
20	52	43	38
21	59	49	43
22	66	56	49
23	73	62	55
24	81	69	61
25	89	77	68

http://users.sussex.ac.uk/~grahamh/RM1web/WilcoxonTable2005.pdf

Exercises about power

These questions use statistics derived from the article:

Jostmann, N. B., Lakens, D., & Schubert, T. W. (2009). Weight as an embodiment of importance. *Psychological Science, 20*(9), 1169-1174.

Exercise 2 **Study 1**

partial eta square = **.12**

See Fig.1 → pwr: 0.624

Exercise 3 **Study 1**

n1 = 20 n2 = 20 F=4.86

t = sqrt(4.86)= 2.204541

d = sqrt(4.86) * sqrt((20+20)/20*20) = 0.697137

J = 1 - (3 / (4*(20+20-2) -1)) = 0.980132

g = J*d = **0.683287**

See Fig.2 → pwr: 0.557 (similar to R)

Fig.1

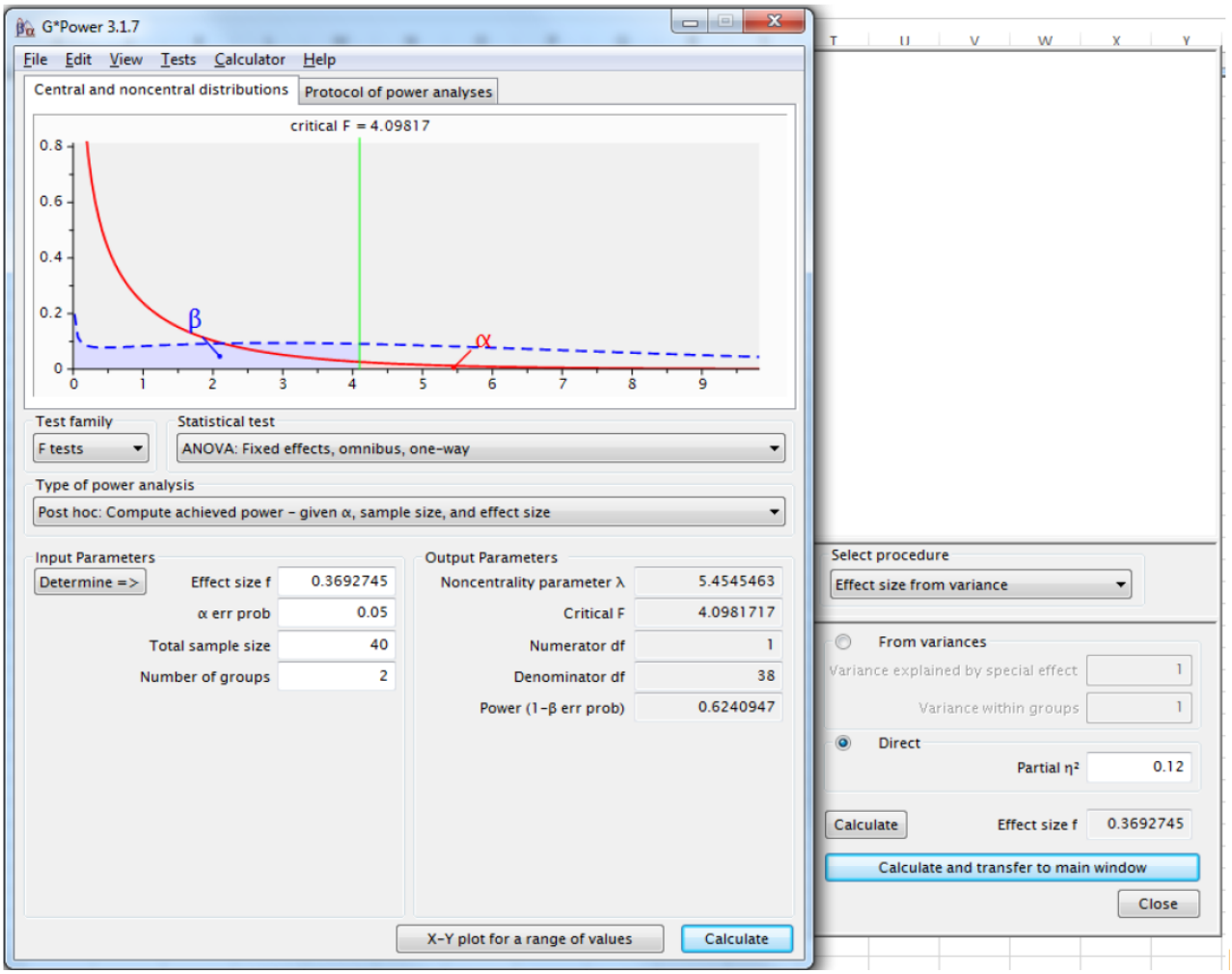
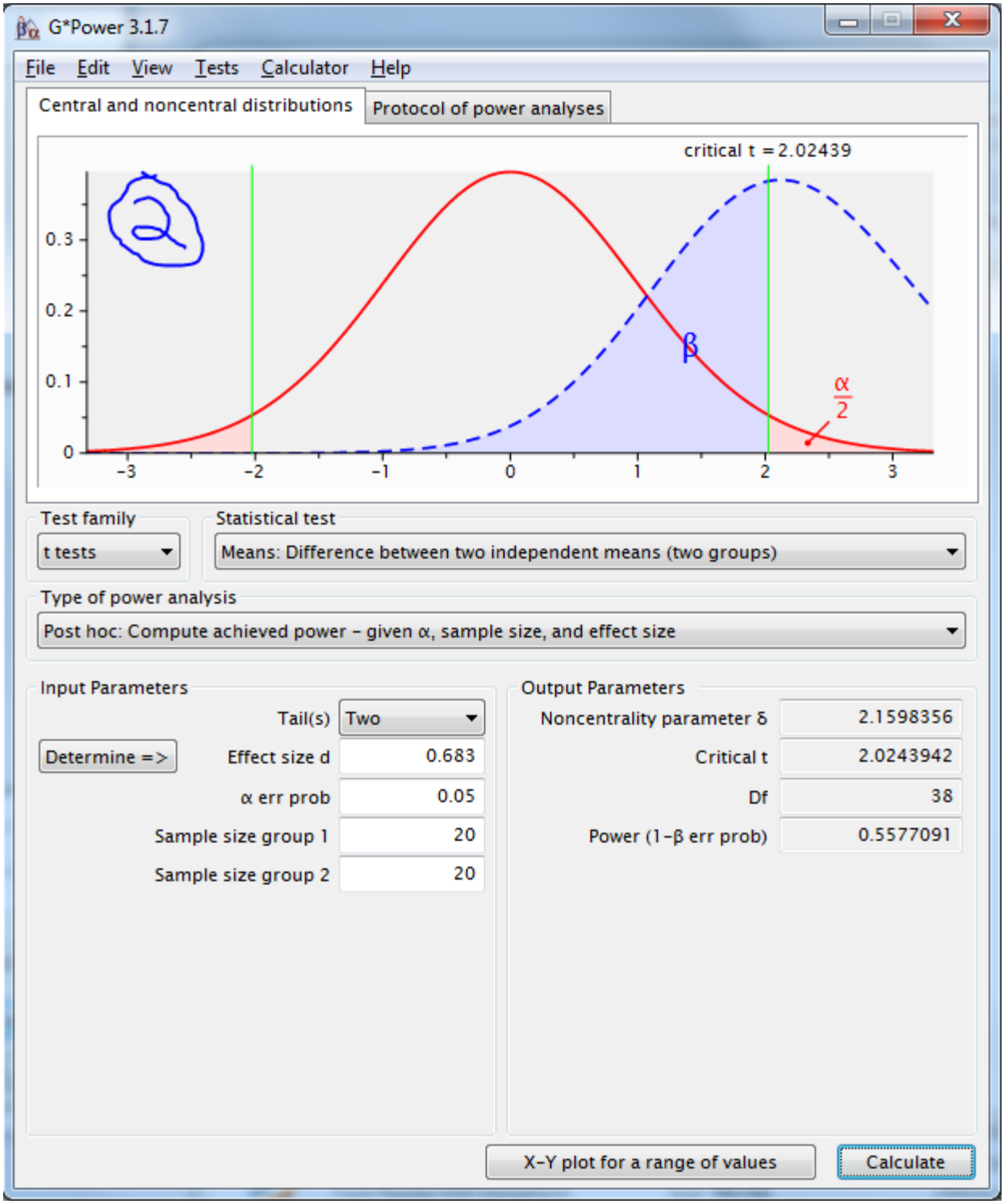


Fig.2


G*Power 3.1.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
critical t = 2.02439
0.3
0.2
0.1
0
−3
−2
−1
0
1
2
3
β
α/2
Test family
t tests
Statistical test
Means: Difference between two independent means (two groups)
Type of power analysis
Post hoc: Compute achieved power – given α, sample size, and effect size
Input Parameters
Tail(s) Two
Determine =>
Effect size d 0.683
α err prob 0.05
Sample size group 1 20
Sample size group 2 20
Output Parameters
Noncentrality parameter δ 2.1598356
Critical t 2.0243942
Df 38
Power (1−β err prob) 0.5577091
X-Y plot for a range of values
Calculate