Wilcoxon test Worked Example:

In order to investigate whether adults report verbally presented material more accurately from their right than from their left ear, a dichotic listening task was carried out. The data were found to be positively skewed.

Number of words reported:

Participant	Left ear	Right ear
1	25	32
2	29	30
3	10	8
4	31	32
5	27	20
6	24	32
7	26	27
8	29	30
9	30	32
10	32	32
11	20	30
12	5	32

What test should we use?

We have two conditions, with each participant taking part in both conditions. Since we are told that the data are skewed, and so do not fulfil the requirements for the use of a parametric test, the appropriate analysis is a Wilcoxon test

(the non-parametric counterpart of the dependent measures t-test).

How to carry out a Wilcoxon test:

a) **Find the differences between each pair of scores**
b) **Rank these differences, ignoring any "0" differences and ignoring the sign of the difference**

[So, different from a Mann Whitney U test, where the data themselves are ranked]

STEP ONE:

Participant	Left ear	Right ear	Difference (d)
1	25	32	- 7
2	29	30	- 1
3	10	8	2
4	31	32	- 1
5	27	20	7
6	24	32	- 8
7	26	27	- 1
8	29	30	- 1
9	30	32	- 2
10	32	32	0
11	20	30	- 10
12	5	32	- 27

STEP TWO:

To rank the differences:

Ignoring the sign of the difference (whether it's positive or negative), the lowest difference is – 1, of which there are 4 instances. So, we add up the ranks they would take e.g., 1 + 2 + 3 + 4 = 10, and then divide this by the number of ranks, so 10 / 4 = 2.5.

The next lowest rank is 2 (there are both positive and negative differences here, but ignore the signs). So, add together ranks 5 + 6 = 11. The ranks assigned would therefore actually be 11 / 2 = 5.5.

Participant	Left ear	Right ear	Difference (d)	Rank
1	25	32	- 7	7.5
2	29	30	- 1	2.5
3	10	8	2	5.5
4	31	32	- 1	2.5
5	27	20	7	7.5
6	24	32	- 8	9
7	26	27	- 1	2.5
8	29	30	- 1	2.5
9	30	32	- 2	5.5
10	32	32	0	omit
11	20	30	- 10	10
12	5	32	- 27	11

STEP THREE:

Add together the ranks belonging to scores with a positive sign:

5.5 + 7.5 = 13

STEP FOUR:

Add together the ranks belonging to scores with a negative sign:

7.5 + 2.5 + 2.5 + 9 + 2.5 + 2.5 + 5.5 + 10 + 11 = 53

STEP FIVE:

Whichever of these sums is the smaller, is our value of W. So, W = 13.

STEP SIX:

N is the number of differences (omitting "0" differences).
We have 12 – 1 = 11 differences.

[Important to note that these are not the same as degrees of freedom. We only use N–1 here because we have 1 difference which equals zero]

STEP SEVEN:

Use the table of critical Wilcoxon values. With an N of 11, what is the critical value for a two-tailed test at the 0.05 significance level?

Critical values For Wilcoxon's signed-rank test

	Two-Tailed Probability			
N	*.05*	*.025*	*.01*	*.005*
5	*1*			
6	*2*	*1*		
7	*4*	*2*	*0*	
8	*6*	*4*	*2*	*0*
9	*8*	*6*	*3*	*2*
10	*11*	*8*	*5*	*3*
11	*14*	*11*	*7*	*5*
12	17	*14*	*10*	*7*
13	21	*17*	*13*	*10*
14	26	*21*	*16*	*13*
15	30	*25*	*20*	*16*
16	36	*30*	*24*	*19*
17	41	*35*	*28*	*23*
18	47	*40*	*33*	*28*
19	54	*46*	*38*	*32*
20	60	*52*	*43*	*37*

The critical value = 14.

With the Wilcoxon test, an obtained W is significant if it is LESS than the critical value.

So, in this case

Obtained W = 13
Critical value = 14

Our obtained value of 13 is *less* than 14, and so we can conclude that there is a difference between the number of words recalled from the right ear and the number of words recalled from the left ear.