For comparing medians of two populations using two independent simple random smaples. Makes no assumptions on the shape of the population distributions.

Example: Two color morphs (green and red) of the same species of sea star were found at North Stradbroke Island. One might suppose that the red color morph is more susceptible to predation and, hence, those found might be smaller than the green color morph. The following data are the radial lengths of two random samples of these sea stars (in mm). Are red color morphs significantly smaller than green color morphs?

	1	2	3	4	6	7	9	10	14.5	21	
red	41	64	80	86	95	98	102	104	111	136	
green	90	99	105	106	107	111	119	119	122	129	135
	5	8	11	12	13	14.5	16	17	18	19	20

IDEA: temporarily combine the two independent samples and rank all of the data from smallest to largest (giving average ranks to ties). Sum the ranks assigned to the smaller sample. If the populations have different medians, then the assignment of ranks will be very different for the two samples.

Let W_X be the sum of the ranks from the smaller sample. (You might call the smaller sample X and the other Y). If the samples are the same size, then W_x is the sum of the ranks from one of the samples, it does not matter which. (Your text refers to W_X as R.)
Compare W_X to the critical values in (included) table C.8. Table C.8. lists two critical values for the test statisic, e.g. 86, 134. We reject H_0 if $W_X \leq 86$ or $W_X \geq 134$.

$H_0: M_R = M_G$ $\quad\quad$ $H_1: M_R < M_G$

$\alpha = .05$

rank combined sample of 21 sea stars.

test stat

W_X = sum of ranks for smaller sized sample.

$= 1+2+3+4+6+7+9+10+14.5+21 = 77.5$

$W_{crit} = 86, 134$ so if $W_X \leq 86$ or $W_X \geq 134$ then reject H_0

Since $W_X = 77.5 \leq W_{crit} = 86$ we reject H_0.

There is evidence the median radial length is smaller for red sea stars than green.

Table C.8 is good for samples up to size 25 each. As long as each sample has at least size 10, we can approximate the distribution of the rank sums with a normal distribution.

Let

$$\mu_W = \frac{n_1(n_1+n_2+1)}{2}, \sigma_W = \sqrt{\frac{n_1 n_2(n_1+n_2+1)}{12}}$$

Now

$$z = \frac{W_x - \mu_W}{\sigma_W}$$

Find the tail probability and double if required for a two-tailed test.

W_x from smaller sample w/ size n_1

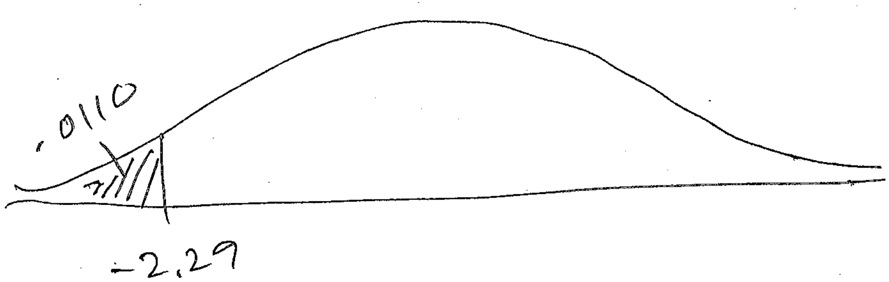
n_2 is the other sample.

$n_1 = 10, \; n_2 = 11, \; W_x = 77.5$

$$\mu_W = \frac{10(10+11+1)}{2} = 110$$

$$\sigma_W = \sqrt{\frac{10 \cdot 11(10+11+1)}{12}} = \sqrt{} = 14.2$$

$$z = \frac{77.5 - 110}{14.2} = -2.29$$



HW: see email