

Mann-Whitney 'U' Calculation Sheet

In this investigation Grasshoppers were sampled by sweep netting and the femur length of each individual was carefully measured and put into 0.5mm size classes. Grasshoppers were carefully released immediately afterwards. Sampling was carried out in early June and again in late July.

Femur length mm	5.0 – 5.49	5.5 – 5.99	6.0 – 6.49	6.5 – 6.99	7.0 – 7.49	7.5 – 7.99	8.0 – 8.49	8.5 – 8.99	9.0 – 9.49	9.5 – 9.99	10.0 – 10.49	10.5 – 10.99	11.0 – 11.49	11.5 – 11.99	12.0 – 12.49	12.5 – 12.99
No. of individuals, June	65	84	101	125	144	120	98	85	75	52	48	25	12	8	2	1
No. of individuals, July	5	9	11	14	19	45	57	78	93	121	155	140	58	45	22	10

There appears to be a difference in the data – there are more larger grasshoppers in July. Even though there are obviously less grasshoppers in the second sample, the group carrying out the sample decided that there was no real difference in the way that they had obtained the two samples, and that the smaller numbers were due to a natural reduction in overall population size.

Is there a difference in the median size of grasshoppers in the 2 samples, as shown by femur length?

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Null Hypothesis: there is no difference in size (median femur length) of grasshoppers in June and July in this site

Alternative Hypothesis: there is a significant difference in size (median femur length) of grasshoppers in June and July in this site

Data set A: Rankings	14	11	7	4	2	6	8	10	13	17	18	21	25	29	31	32	R_a 248
Data set A: Observations	65	84	101	125	144	120	98	85	75	52	48	25	12	8	2	1	n_a 16
Data set B: Observations	5	9	11	14	19	45	57	78	93	121	155	140	58	45	22	10	n_b 16
Data set B: Rankings	30	28	26	24	23	19.5	16	12	9	5	1	3	15	19.5	22	27	280 R_b

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32

Now check that:

$$R_a + R_b = \frac{[(n_a + n_b)(n_a + n_b + 1)]}{2} \Rightarrow R_a + R_b = \boxed{528} \quad \frac{[(n_a + n_b)(n_a + n_b + 1)]}{2} = \boxed{528}$$

Calculate your test values using the equations below:

$$U_a = n_a n_b + \frac{n_b(n_b + 1)}{2} - R_b \Rightarrow U_a = \boxed{256} + \boxed{141} - \boxed{280} = \boxed{117}$$

$$U_b = n_a n_b + \frac{n_a(n_a + 1)}{2} - R_a \Rightarrow U_b = \boxed{256} + \boxed{141} - \boxed{248} = \boxed{149}$$

n_a =

Critical

Since the smaller U value is greater than the critical

U

CV

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$n_b =$ 16
Value =
75
value, you can fail to reject your null hypothesis and reject your alternative hypothesis

117
>
75

Table of critical values of U at the 5% probability level

N_a ↓	$N_b \rightarrow$																		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2
3	0	0	0	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
4	0	0	0	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	13
5	0	0	1	2	3	5	6	7	8	9	11	12	13	14	15	17	18	19	20
6	0	1	2	3	5	6	7	9	11	12	14	16	17	19	21	22	24	25	27
7	0	1	3	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
8	0	2	4	6	8	10	13	15	17	19	22	24	26	29	31	34	36	39	41
9	0	2	4	7	10	12	15	17	20	23	26	28	31	34	37	39	42	45	48
10	0	3	5	8	11	14	17	20	23	26	29	33	36	39	42	45	48	52	55
11	0	3	6	9	13	16	19	23	26	30	33	37	40	44	47	51	55	58	62
12	1	4	7	11	14	18	22	26	29	33	37	41	45	49	53	57	61	65	69
13	1	4	8	12	16	20	24	28	33	37	41	45	50	54	59	63	67	72	76
14	1	5	9	13	17	22	26	31	36	40	45	50	55	59	64	67	74	78	83
15	1	5	10	14	19	24	29	34	39	44	49	54	59	64	70	75	80	85	90
16	1	6	11	15	21	26	31	37	42	47	53	59	64	70	75	81	86	92	98
17	2	6	11	17	22	28	34	39	45	51	57	63	67	75	81	87	93	99	105
18	2	7	12	18	24	30	36	42	48	55	61	67	74	80	86	93	99	106	112
19	2	7	13	19	25	32	38	45	52	58	65	72	78	85	92	99	106	113	119
20	2	8	13	20	27	34	41	48	55	62	69	76	83	90	98	105	112	119	127