

### Some Chapter 4 Practice Problems

1. Suppose we have two independent random samples from two populations as below. Suppose our null hypothesis is that populations 1 and 2 have the same distribution, and our alternative hypothesis is that population 2 tends to have bigger values than population 1.

Sample 1 : 1 1 2 5  
 Sample 2 : 1 1 2 2 3 4 7 15 32 41 77 107 299 977

- (a) Without using SAS, provide a one-sided permutation  $p$ -value. Show your work.
- (b) Without using SAS, provide an approximate one-sided  $p$ -value for the rank-sum test by computing a  $Z$ -statistic and comparing its value to the standard normal distribution.
2. Reconsider the experiment to compare the effectiveness of two virus preparations on tobacco leaves that we discussed in class. Suppose that 20 leaves were used and that the counts of the number of lesions per half leaf were as follows.

<b>Leaf</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<b>Prep. 1</b>	2	0	7	9	13	15	14	22	20	27	32	21	44	47	51	47	67	72	69	71
<b>Prep. 2</b>	12	1	3	2	5	4	2	7	4	10	14	2	20	20	20	12	22	24	15	16

- (a) Compute the signed-rank statistic  $S$ .
- (b) Compute a  $Z$ -statistic based on the normal approximation to the distribution of  $S$ .
- (c) Approximate a two-sided  $p$ -value based on the  $Z$ -statistic.
- (d) Find the exact one-sided  $p$ -value for the signed rank test. Double that  $p$ -value to get the exact two-sided  $p$ -value.
- (e) Conduct a sign test for this data. Compute a test statistic  $Z$ , and provide an approximate two-sided  $p$ -value.