By entering the contrast coefficients, \( c_1 = 2, c_2 = -1, c_3 = -1 \) for \( C_1 \) and \( c_1 = 0, c_2 = 1, c_3 = -1 \) for \( C_2 \).
Practical 3.2: One-way ANOVA with linear contrasts

Example 1
Return to the tapping data in practical 3.1.
Use Analyze/Compare Means/One-way ANOVA and the Contrasts option to specify linear contrasts to test
a) the 0 treatment (the control group) with the average of the other three treatments,
b) the 0 treatment with the treatment with the highest dose of caffeine.

Example 2
An experiment was conducted to study the effect of food and/or water deprivation on behaviour in a learning task. Treatment 1 and 2 represent control conditions in which the animal received ad lib food and water (1) or else food and water twice per day (2). In treatment 3 animals were food deprived, in treatment 4, they were water deprived, and in treatment 5 they were deprived of both food and water. The number of trials to reach a predetermined criterion was recorded as follows:

<table>
<thead>
<tr>
<th>Ad Lib Control</th>
<th>Two per Day Control</th>
<th>Food Deprived</th>
<th>Water deprived</th>
<th>Food and Water deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>20</td>
<td>6</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>20</td>
<td>25</td>
<td>9</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>21</td>
<td>23</td>
<td>8</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>16</td>
<td>27</td>
<td>11</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>11</td>
<td>14</td>
<td>11</td>
</tr>
</tbody>
</table>

1. Enter the data into one named column and create a grouping variable for the treatment groups.
2. Use Analyze/Compare Means/One-way ANOVA to produce an ANOVA table.
3. Use the Contrasts option to specify linear contrasts to compare
   a) combined control groups (treatments 1 and 2) versus combined experimental groups
   b) control groups with each other
   c) the singly deprived groups treatments with the doubly deprived treatment
   d) the singly deprived treatments with each other
Questions for Practical 3.2

Tapping experiment
i) Write down the linear contrasts that correspond to the planned comparisons.

ii) State the null and alternative hypotheses for using the two contrasts to test.

iii) For each test, what is the p-value and do you reject the null hypothesis?

iv) Give a 95% confidence interval for the change in the number of taps per minute due to using a very large dose of caffeine.

Behaviour in learning experiment
i) Interpret the results of the analysis of variance.

ii) Write down the linear contrasts that correspond to the planned comparisons.

iii) Show that the contrasts are orthogonal.

iv) What can you conclude from the tests of the four contrasts?