| Treatment → | A | B | C | D | E | F | G | H |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Input Data → | 4.0 10.0 5.0 5.0 8.0 5.0 3.0 8.0 8.0 5.0 7.0 10.0 5.0 6.0 7.0 10.0 11.0 7.0 12.0 9.0 3.0 5.0 9.0 7.0 13.0 6.0 10.0 8.0 7.0 10.0 4.0 8.0 | 6.0 13.0 12.0 8.0 10.0 15.0 13.0 7.0 11.0 5.0 11.0 12.0 6.0 12.0 9.0 11.0 12.0 6.0 9.0 4.0 7.0 9.0 10.0 5.0 9.0 8.0 16.0 7.0 7.0 12.0 6.0 8.0 | 6.0 8.0 4.0 7.0 8.0 6.0 7.0 4.0 9.0 7.0 5.0 6.0 6.0 3.0 3.0 4.0 5.0 5.0 5.0 9.0 7.0 6.0 5.0 3.0 7.0 6.0 5.0 7.0 4.0 4.0 7.0 8.0 | 11.0 12.0 5.0 6.0 10.0 10.0 8.0 9.0 8.0 6.0 11.0 7.0 7.0 12.0 9.0 10.0 11.0 6.0 12.0 9.0 7.0 6.0 7.0 9.0 3.0 13.0 11.0 6.0 4.0 6.0 6.0 13.0 | 21.0 15.0 7.0 17.0 22.0 10.0 13.0 13.0 21.0 19.0 15.0 12.0 16.0 14.0 16.0 14.0 11.0 13.0 13.0 15.0 9.0 16.0 8.0 15.0 13.0 10.0 29.0 18.0 7.0 14.0 9.0 14.0 | 22.0 18.0 5.0 28.0 17.0 21.0 13.0 13.0 25.0 13.0 24.0 4.0 16.0 18.0 10.0 18.0 15.0 8.0 7.0 5.0 10.0 22.0 18.0 17.0 17.0 12.0 15.0 14.0 8.0 13.0 13.0 19.0 | 7.0 10.0 21.0 13.0 14.0 25.0 20.0 27.0 31.0 15.0 23.0 14.0 10.0 9.0 22.0 13.0 22.0 17.0 15.0 18.0 13.0 15.0 20.0 11.0 15.0 9.0 11.0 6.0 6.0 8.0 7.0 14.0 | 6.0 14.0 8.0 18.0 22.0 18.0 6.0 53.0 20.0 21.0 22.0 25.0 18.0 13.0 11.0 22.0 23.0 16.0 22.0 9.0 18.0 14.0 10.0 15.0 12.0 13.0 13.0 6.0 10.0 9.0 9.0 14.0 |

**INDICATOR 1**

**Descriptive statistics of the k=8 independent treatments:**

| **Treatment →** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **Pooled Total** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **observations N** | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 256 |
| **sum ∑xi** | 235.0000 | 296.0000 | 186.0000 | 270.0000 | 459.0000 | 478.0000 | 481.0000 | 510.0000 | 2,915.0000 |
| **mean ¯x** | 7.3438 | 9.2500 | 5.8125 | 8.4375 | 14.3438 | 14.9375 | 15.0312 | 15.9375 | 11.3867 |
| **sum of squares ∑x2i** | 1,933.0000 | 3,024.0000 | 1,170.0000 | 2,504.0000 | 7,267.0000 | 8,252.0000 | 8,499.0000 | 10,492.0000 | 43,141.0000 |
| **sample variance s2** | 6.6845 | 9.2258 | 2.8669 | 7.2863 | 22.0393 | 35.8669 | 40.9345 | 76.2540 | 39.0146 |
| **sample std. dev. s** | 2.5854 | 3.0374 | 1.6932 | 2.6993 | 4.6946 | 5.9889 | 6.3980 | 8.7324 | 6.2462 |
| **std. dev. of mean SE¯x** | 0.4570 | 0.5369 | 0.2993 | 0.4772 | 0.8299 | 1.0587 | 1.1310 | 1.5437 | 0.3904 |

**One-way ANOVA of your k=8 independent treatments:**

| source | sum of squares SS | degrees of freedom ν | mean square MS | F statistic | p-value |
| --- | --- | --- | --- | --- | --- |
| treatment | 3,712.8086 | 7 | 530.4012 | 21.0939 | 1.1102e-16 |
| error | 6,235.9062 | 248 | 25.1448 |  |  |
| total | 9,948.7148 | 255 |  |  |  |

**Conclusion from Anova:**

The p-value corresponing to the F-statistic of one-way ANOVA is lower than 0.05, suggesting that the one or more treatments are significantly different. The Tukey HSD test, Scheffé, Bonferroni and Holm multiple comparison tests follow. These post-hoc tests would likely identify which of the pairs of treatments are significantly differerent from each other.

**Post-hoc Turkey HSD Test Calculator results:**

| treatments pair | Tukey HSD Q statistic | Tukey HSD p-value | Tukey HSD inferfence |
| --- | --- | --- | --- |
| A vs B | 2.1505 | 0.7695184 | insignificant |
| A vs C | 1.7274 | 0.8999947 | insignificant |
| A vs D | 1.2339 | 0.8999947 | insignificant |
| A vs E | 7.8968 | 0.0010053 | \*\* p<0.01 |
| A vs F | 8.5666 | 0.0010053 | \*\* p<0.01 |
| A vs G | 8.6723 | 0.0010053 | \*\* p<0.01 |
| A vs H | 9.6947 | 0.0010053 | \*\* p<0.01 |
| B vs C | 3.8779 | 0.1153869 | insignificant |
| B vs D | 0.9166 | 0.8999947 | insignificant |
| B vs E | 5.7463 | 0.0016507 | \*\* p<0.01 |
| B vs F | 6.4161 | 0.0010053 | \*\* p<0.01 |
| B vs G | 6.5219 | 0.0010053 | \*\* p<0.01 |
| B vs H | 7.5442 | 0.0010053 | \*\* p<0.01 |
| C vs D | 2.9613 | 0.4243475 | insignificant |
| C vs E | 9.6242 | 0.0010053 | \*\* p<0.01 |
| C vs F | 10.2940 | 0.0010053 | \*\* p<0.01 |
| C vs G | 10.3998 | 0.0010053 | \*\* p<0.01 |
| C vs H | 11.4221 | 0.0010053 | \*\* p<0.01 |
| D vs E | 6.6629 | 0.0010053 | \*\* p<0.01 |
| D vs F | 7.3327 | 0.0010053 | \*\* p<0.01 |
| D vs G | 7.4385 | 0.0010053 | \*\* p<0.01 |
| D vs H | 8.4608 | 0.0010053 | \*\* p<0.01 |
| E vs F | 0.6698 | 0.8999947 | insignificant |
| E vs G | 0.7756 | 0.8999947 | insignificant |
| E vs H | 1.7979 | 0.8999947 | insignificant |
| F vs G | 0.1058 | 0.8999947 | insignificant |
| F vs H | 1.1281 | 0.8999947 | insignificant |
| G vs H | 1.0223 | 0.8999947 | insignificant |

**Scheffé multiple comparison:**

|  |  |  |  |
| --- | --- | --- | --- |
| treatments pair | Scheffé T-statistic | Scheffé p-value | Scheffé inferfence |
| A vs B | 1.5206 | 0.9397136 | insignificant |
| A vs C | 1.2215 | 0.9822245 | insignificant |
| A vs D | 0.8725 | 0.9977599 | insignificant |
| A vs E | 5.5839 | 0.0001095 | \*\* p<0.01 |
| A vs F | 6.0575 | 1.3529e-05 | \*\* p<0.01 |
| A vs G | 6.1323 | 9.5683e-06 | \*\* p<0.01 |
| A vs H | 6.8552 | 2.7179e-07 | \*\* p<0.01 |
| B vs C | 2.7421 | 0.3805235 | insignificant |
| B vs D | 0.6481 | 0.9996801 | insignificant |
| B vs E | 4.0633 | 0.0238375 | \* p<0.05 |
| B vs F | 4.5369 | 0.0056326 | \*\* p<0.01 |
| B vs G | 4.6117 | 0.0043954 | \*\* p<0.01 |
| B vs H | 5.3346 | 0.0003057 | \*\* p<0.01 |
| C vs D | 2.0939 | 0.7339294 | insignificant |
| C vs E | 6.8053 | 3.5161e-07 | \*\* p<0.01 |
| C vs F | 7.2790 | 2.8504e-08 | \*\* p<0.01 |
| C vs G | 7.3537 | 1.8919e-08 | \*\* p<0.01 |
| C vs H | 8.0766 | 3.0302e-10 | \*\* p<0.01 |
| D vs E | 4.7114 | 0.0031316 | \*\* p<0.01 |
| D vs F | 5.1850 | 0.0005516 | \*\* p<0.01 |
| D vs G | 5.2598 | 0.0004116 | \*\* p<0.01 |
| D vs H | 5.9827 | 1.9047e-05 | \*\* p<0.01 |
| E vs F | 0.4736 | 0.9999615 | insignificant |
| E vs G | 0.5484 | 0.9998958 | insignificant |
| E vs H | 1.2713 | 0.9775765 | insignificant |
| F vs G | 0.0748 | 1.0000000 | insignificant |
| F vs H | 0.7977 | 0.9987435 | insignificant |
| G vs H | 0.7229 | 0.9993403 | insignificant |

**Bonferroni and Holm results: all pairs simultaineously compared:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| treatments pair | Bonferroni and Holm TT-statistic | Bonferroni p-value | Bonferroni inferfence | Holm p-value | Holm inferfence |
| A vs B | 1.5206 | 3.6297340 | insignificant | 1.2963336 | insignificant |
| A vs C | 1.2215 | 6.2459230 | insignificant | 1.7845494 | insignificant |
| A vs D | 0.8725 | 10.7461760 | insignificant | 2.6865440 | insignificant |
| A vs E | 5.5839 | 1.7260e-06 | \*\* p<0.01 | 1.2329e-06 | \*\* p<0.01 |
| A vs F | 6.0575 | 1.4274e-07 | \*\* p<0.01 | 1.1215e-07 | \*\* p<0.01 |
| A vs G | 6.1323 | 9.5062e-08 | \*\* p<0.01 | 7.8087e-08 | \*\* p<0.01 |
| A vs H | 6.8552 | 1.5735e-09 | \*\* p<0.01 | 1.4049e-09 | \*\* p<0.01 |
| B vs C | 2.7421 | 0.1834057 | insignificant | 0.0786024 | insignificant |
| B vs D | 0.6481 | 14.4900866 | insignificant | 2.0700124 | insignificant |
| B vs E | 4.0633 | 0.0018195 | \*\* p<0.01 | 0.0008447 | \*\* p<0.01 |
| B vs F | 4.5369 | 0.0002492 | \*\* p<0.01 | 0.0001246 | \*\* p<0.01 |
| B vs G | 4.6117 | 0.0001793 | \*\* p<0.01 | 9.6048e-05 | \*\* p<0.01 |
| B vs H | 5.3346 | 6.0421e-06 | \*\* p<0.01 | 4.1000e-06 | \*\* p<0.01 |
| C vs D | 2.0939 | 1.0438503 | insignificant | 0.4100841 | insignificant |
| C vs E | 6.8053 | 2.1081e-09 | \*\* p<0.01 | 1.8069e-09 | \*\* p<0.01 |
| C vs F | 7.2790 | 1.2406e-10 | \*\* p<0.01 | 1.1520e-10 | \*\* p<0.01 |
| C vs G | 7.3537 | 7.8468e-11 | \*\* p<0.01 | 7.5665e-11 | \*\* p<0.01 |
| C vs H | 8.0766 | 8.1446e-13 | \*\* p<0.01 | 8.1446e-13 | \*\* p<0.01 |
| D vs E | 4.7114 | 0.0001148 | \*\* p<0.01 | 6.5626e-05 | \*\* p<0.01 |
| D vs F | 5.1850 | 1.2558e-05 | \*\* p<0.01 | 7.6242e-06 | \*\* p<0.01 |
| D vs G | 5.2598 | 8.7273e-06 | \*\* p<0.01 | 5.6104e-06 | \*\* p<0.01 |
| D vs H | 5.9827 | 2.1359e-07 | \*\* p<0.01 | 1.6020e-07 | \*\* p<0.01 |
| E vs F | 0.4736 | 17.8130424 | insignificant | 1.2723602 | insignificant |
| E vs G | 0.5484 | 16.3492228 | insignificant | 1.7517024 | insignificant |
| E vs H | 1.2713 | 5.7345252 | insignificant | 1.8432402 | insignificant |
| F vs G | 0.0748 | 26.3325173 | insignificant | 0.9404470 | insignificant |
| F vs H | 0.7977 | 11.9227220 | insignificant | 2.5548690 | insignificant |
| G vs H | 0.7229 | 13.1716636 | insignificant | 2.3520828 | insignificant |