11.37

The quality director for a clothing manufacturer wants to study the effect of operators and machines on the breaking strength (in pounds) of wool serge material. A batch of the material is cut into square-yard pieces and these are randomly assigned, 3 each, to all combinations of 4 operators and 3 machines. The results are shown in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Machine I** | **Machine II** | **Machine III** |
| Operator A | 115 | 111 | 109 |
|  | 115 | 108 | 110 |
|  | 119 | 114 | 107 |
| Operator B | 117 | 105 | 110 |
|  | 114 | 102 | 113 |
|  | 114 | 106 | 114 |
| Operator C | 109 | 100 | 103 |
|  | 110 | 103 | 102 |
|  | 106 | 101 | 105 |
| Operator D | 112 | 105 | 108 |
|  | 115 | 107 | 111 |
|   | 111 | 107 | 110 |

At 0.05 level of significance test whether or not there

1. Is an interaction between operators and machines?
2. Is there an effect due to operator?
3. Is there an effect due to machine?
4. Plot the mean breaking strength for each operator for each machine.
5. If appropriate, use the Tukey procedure to examine differences among operators and among machines.
6. What can you conclude about the effects of operators and machines on breaking strength? Explain.