1. A sleep deprivation study has produced the following (partial) ANOVA table:

| | df | SS | MS | F |
|---|---|---|---|---|
| Treatment | 2 | 660.3 | 330.2 | 6.263 |
| Error | 21 | 1107.0 | 52.7 | |

1.1. This design is balanced. What is the per group sample size and the number of groups? Show your work.

1.2. Calculate $\eta^2$, $\hat{\omega}^2$ and $\widetilde{R^2}$. Which of the three is the most recommended? Why? Interpret this estimate.

2. Consider a balanced design with $k = 4$ groups. Use WebPower for the following. Attach screenshots.

2.1. Find the power of this design with per-group sample size 10 to detect $\omega^2 = 0.15$ in an ANOVA. Show a screenshot.

2.2. Find the minimum per-group sample size to detect $f = 0.40$ in an ANOVA with power 0.8 by WebPower.

3. Consider the contrast

$$\psi = \frac{\mu_1 + \mu_2}{2} - \frac{\mu_3 + \mu_4 + \mu_5}{3}$$

in a balanced design with 5 groups and per-group sample size of 5.

3.1. Find the power of this design to detect $d = 0.5$ for this contrast in a two sided test at $\alpha = 0.05$. Use WebPower and attach a screenshot.

3.2. Find the minimum per-group sample size for this design to achieve a power of 0.8 in detecting $d = 0.5$ for the contrast in a two sided test at $\alpha = 0.05$. Use WebPower and attach a screenshot.