Module 3F Questions:

1. Two clinical trials are carried out which both test the same null hypothesis under the same conditions with α = 0.05. Trial A has 45 individuals and Trial B has 100 individuals. Power=1-type II (Beta). Which of the following is true about the two trials described above:
    a. Study A has higher probability of type I error than Study B and Study B has a higher probability of type II error than Study A
    b. Study A has a lower probability of type I error than Study B and Study B has a lower probability of type II error than Study A
    c. Study A has the same type I error as Study B and Study A has a higher probability of type II error than Study B. B/c Power=1-P(type II error)
    d. Study A has the same type I error as Study B and Study B also has a higher probability of type II error than Study A

2. You are testing whether a new **high-fat diet** affects behavior in an inbred strain of mice. You take **40 male mice** and randomly assign them to:

    - **Control diet:** 20 mice
    - **High-fat diet:** 20 mice

After 8 weeks, you measure **20 different behavioral and physiological outcomes** (each analyzed separately with an independent t-test at $\alpha = 0.05$):

- open-field activity
- time in center (anxiety)
- rotarod performance
- grip strength
- tail suspension immobility
- forced swim immobility
- sucrose preference
- maze latency
- rearing count
- grooming time
- plus 10 more similar measures…

Assume that the **high-fat diet has <u>no effect</u> on any of these 20 outcomes** (all null hypotheses are actually true).

1. If you test **only 1 outcome** at $\alpha = 0.05$, what is the probability of getting at least one "significant" result just by chance?

2. If you test **all 20 outcomes independently**, each at $\alpha = 0.05$, what is the probability of getting **at least one false positive** just by chance, assuming all nulls are true? Hint: Use the fact that the probability of **no** false positives in 20 tests is:

$$(1-0.05)^{20}$$

3. Interpret your answer to (2) in the context of mouse behavior studies:
    - If you run **this exact experiment many times**, in what proportion of experiments would you expect to see at least one "significant" result purely by chance, even though the diet actually does nothing?
4. If each of the 20 tests has a 5% chance of being (falsely) significant when the null is true, what is the **expected number of false positive significant results** among the 20 tests?