Task A) Two-sample t-testing (paired samples)

Suppose a company wants to evaluate the effectiveness of a compliance training program for their employees. They take two measurements accessing the scores (0-25) for the compliance knowledge test: one before the employees started with the compliance training, and one after they finished.
In the following table you find the compliance knowledge scores for each of the 20 employees tested before and after they took part in the compliance training:

Employees	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Scores before training	10	15	9	21	16	7	22	18	10	15	7	16	24	16	9	19	21	15	14	17
Scores after training	11	9	11	17	22	13	20	19	18	18	5	12	24	18	10	13	24	18	19	14

(1) What are your null and alternative hypotheses? H0: means are the same; H1: mean after is larger/smaller than mean before

(2) Can the company assume that there is any effect of their compliance training for the employees based on your calculations? Explain why there is / is not an effect. Can you verify this using R? You can also use SPSS if you really have to.

Task B) Two-sample t-testing (between samples)

Suppose a huge pharmacy company wants to evaluate the effectiveness of a new pill treating Alzheimer. They take two different samples: one samples receives the pill, and the other sample receives a placebo pill. After the treatment both samples have to fill in the Alzheimer self-test (score range 0-135).
In the following table you find the Alzheimer self-test scores for each participant of the two different samples:

Groups	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Scores of pill sample	13	100	105	94	21	16	78	42	81	109	105	71	63	44		
Scores of placebo sample	15	101	96	101	19	42	131	120	109	84	89	53	121	24	88	102

(1) What are your null and alternative hypotheses?

(2) Can the pharmacy company assume that their pill has any effect on Alzheimer? Explain why there is / is not an effect. Can you verify this using R? Again you can also use SPSS, but you should know better by now.

Task C) One-Way ANOVA

A researcher is interested in comparing three new designs for media players. There is a particular interest in knowing if the designs differ in "cool appeal" for young users. 21 young tech-savvy participants are recruited and split into three groups of 7. Each group is given demos of one of the three media players (MPA, MPB, MPC). The participants are asked to rate the designs for cool appeal on a 10-point linear scale (1 = not cool at all, 10 = really cool). Are there any differences between the three conditions using alpha=0.05? The data are given in the following table:

MPA	MPB	MPC
9	7	4
8	6	3
7	5	2
8	7	3
7	8	4
8	7	3
8	6	2

(1) Fill in the gaps:

a. The independent variable is _____, with ___ levels.
b. The dependent variable is _____ _____
c. There are _____ experimental conditions and r _____ participants per condition.
d. This is a _____ group experiment design.
e. Define null and alternative hypotheses:
   i. H_0: _____ _____ _____ _____ ___
   ii. H_1: _____ _____ _____ _____

Can you obtain the values below using R or SPSS?

(2) Calculate degrees of freedom:

a. $df_{between}$=

b. df_{within}=
c. df_{total}=

(3) Calculate sum of squares:

a. $SS_{between}$=
b. SS_{within}=
c. SS_{Total}=

(4) Calculate mean squares:

a. $MS_{between}$=
b. MS_{within}=

(5) Calculate F:

$F = \frac{MS_{between}}{MS_{within}}$=

(6) Fill in the summary table

Source of variation	Sum of Squares	df	Mean Square	F	p
Between groups					
Within groups					
Total					

(7) Are there any differences between the three conditions using alpha=0.05? Please report the results: