

## Task A) ANOVA

A researcher is interested in comparing texting speeds on a mobile phone while sitting, walking and running. There is a particular interest in knowing if the texting speed differ based on the mobility of a user. 5 participants are recruited. The participants are asked to type text on a mobile phone in all mobility conditions (sitting, walking, and running). The order of the mobility conditions are randomized. Are there any differences between the three conditions using  $\alpha=0.05$ ? The data are given in the following table:

Sitting	Walking	Running
13	10	7
14	11	9
12	9	8
12	13	10
15	14	11

(1) Fill in the space:

- The independent variable is \_\_\_\_\_, with \_\_\_\_ levels.
- The dependent variable is \_\_\_\_\_

- There are \_\_\_\_\_ experimental.
- This is a \_\_\_\_\_ group experiment design.
- Define null and alternative hypotheses:

i.  $H_0$ :

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ii.  $H_1$ :

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(2) Calculate degrees of freedom:

- $df_{between} =$
- $df_{within} =$
- $df_{total} =$

(3) Calculate sum of squares:

- $SS_{between} =$
- $SS_{within} =$
- $SS_{Total} =$

(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) Calculate the effect size (Eta-squared and f):

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

(9) Run the Tukey HSD test as a post-hoc test, if appropriate:

(10) Please report the results of ANOVA considering the post-hoc test:

## Task B) ANOVA

An experiment with 5 participants sought to determine if interaction with touchscreen phones is improved using the flick gesture and whether the improvement, if any, is related to one-handed versus two-handed interaction. A variety of map-locating tasks were devised. All tasks were of equal difficulty. For each task, participants were presented with a starting location and were required to navigate to a final location using finger gestures on the map image. To avoid visual search in the task, the map and locations were familiar to participants. The system was configured to have a drag-only mode (flick disabled) and a drag + flick mode. The results for task completion time are shown below:

Participant	Task Completion Time (s)			
	One-handed		Two-handed	
	Drag-only	Drag+flick	Drag-only	Drag+flick
P1	12	11	7	6
P2	11	7	6	8
P3	9	8	8	7
P4	9	9	7	6
P5	13	5	6	5

Perform an ANOVA on the data to determine if there is an effect of hand use (one-handed, two-handed) or interaction method (drag-only, drag + flick) on task completion time for the map-locating task.

(1) Calculate all steps and fill in the table ( $\alpha=0.05$ ):

Source of variation	SS	df	MS	F	P	crit F	eta <sup>2</sup>	f
H (Hand use)								
I (Interaction method)								
HI (Hand use x Interaction method)								
Error								
Total								

(2) Please report the results: