STAT 212-501 (Fall 2022)

Homework 4

Do the following 3 exercises. The first two are typed in here, while the last is from your textbook.

1. It is hypothesized that when homing pigeons are disoriented in a certain manner, they will exhibit no preference for any direction of flight after takeoff (so that the direction X should be uniformly distributed on the interval from $0°$ to $360°$). To test this, 120 pigeons are disoriented, let loose, and the direction of flight of each is recorded. The resulting raw data is then categorized into several intervals and the counts are tabulated below. Use the χ^2 test at level 0.10 to see whether the data support the hypothesis.

Direction	$[0°, 45°)$	$[45°, 90°)$	$[90°, 135°)$	$[135°, 180°)$
Frequency	12	16	17	15

Direction	$[180°, 225°)$	$[225°, 270°)$	$[270°, 315°)$	$[315°, 360°)$
Frequency	13	20	17	10

2. In a genetics experiment, investigators looked at 300 chromosomes of a particular type and counted the number of sister-chromatid exchanges on each ("On the Nature of Sister-Chromatid Exchanges in 5-Bromodeoxyuridine-Substituted Chromosomes", *Genetics, 1979: 1251-1264*). A Poisson model was hypothesized for the distribution of the number of exchanges, x. Test the fit of a Poisson distribution to the observed data below by first estimating θ and then combining the counts for $x \geq 8$ into one category.

Number of Exchanges	0	1	2	3	4	5	6	7	8	9
Observed Counts	6	24	42	59	62	44	41	14	6	2

3. Problem 10, pg. 360 of textbook *(Akritas, First Ed.)*.

Instructions for all problems above:

(i) For all problems, you **must** clearly **describe how the problem setting relates** to methods learnt in class. You must also **formally state (in notations) what hypotheses you are testing** and **how you are going to test them**. You **must show details of all your work**, including all steps of your calculations and a **clear statement of your final answer** (with justifications) to each question asked.

(ii) I **strongly recommend** that you should use **hand calculations** (including use of calculators and distribution tables) for all problems as much as possible. This is in your best interest as it will help you for exam preparations! However, if you must use R at any stage (e.g. for computing P-values), you may do so as long as you provide all your code and output along with a clear statement of your final answer.

General Instructions and Things to Keep in Mind:

1. All homework **submissions must be made online via Canvas.** (In case you are not familiar, I have also posted a set of guidelines on how to do this in `Canvas` under `Homework Assignments`.)

2. Your solutions must be uploaded **as a single pdf file** with your **name, course-section and email id clearly printed** on the first page. Your solutions may include a combination of typed pages and/or hand-written documents (properly scanned) and/or `R` codes with outputs (embedding screenshots of these is acceptable). But they **must** be all combined into a single pdf file and submitted in `eCampus`.

3. It is **your responsibility to ensure** that your **uploaded homework solution is complete, clear and fully legible,** especially if there are scans of hand-written documents involved. If not, the TA may be forced to ignore the affected questions and deduct all allotted points!

4. The **deadline is strict.** (No unwarranted exceptions and/or extension requests will be entertained.)

5. For all exercises, you may use a standard scientific calculator or `R/RStudio` for any numerical calculations required. In either case, you must show all relevant intermediate steps to get to the result.

6. For all software implementations via `R/RStudio`, you **must include all the relevant `R` code along with the outputs, and a clear statement of your final answer(s) to the question(s) asked.**

7. For all exercises, you should **show all your work,** including intermediate calculations and all relevant `R` codes/outputs, as applicable. Otherwise the TA may choose **not** to give you any partial credit.