Here are some questions to direct your reading of Excursion 3 Tour I. (I am not collecting these, but some will appear as choices in the next assignment.) We will be splitting this excursion over the next two classes. I will save GTR for Mar 1, so you can skip those pages for now.

Please check the latest syllabus on my blog. It is now the third blogpost on https://errorstatistics.com.

1. Try to outline (not for collection) the key concepts of Fisher and N-P tests: test statistic, P-value, type I and type II errors, uniformly powerful test (UMP) test.

2. Explain key aspects of the Fisher vs Neyman-Pearson controversy. Why is the Fisher-Neyman dispute said to be "pathological". SIST discusses the "triad" in Excursion 5 pp 388-391. The "triad" is also on my current blog for Fisher's birthday: https://errorstatistics.com/2023/02/17/happy-birthday-r-a-fisher-statistical-methods-and-scientific-induction-with-replies-by-neyman-and-e-s-pearson/

3. Try your hand at the exercises on P-values and severity on the next two pages, computing by hand or using the Morey app (linked on the next page).

https://richarddmorey.shinyapps.io/severity/?mu0=150&mu1=150&sigma=10&n=100&xbar=152&xmin=145&xmax=155&alpha=0.05&dir=%3E

Areas under the standard Normal distribution (to the right of z)

z	0	.5	1	1.5	1.65	1.96	2	2.5	3	4
Pr(Z $\geq$ z)	.5	.3	.16	.07	.05	.025	.023	.005	.001	~1

$H_0: \mu \leq 150$ vs. $H_1: \mu > 150$.

To get the (one-sided) P-value associated with $\mu \leq 150$ for a given value of $\bar{X}$

1. Turn $\bar{X}$ into a standard Normal variable, i.e., a z score: subtract the hypothesized mean (150) from the observed sample mean $\bar{X}$ and divide by the standard deviation of $\bar{X}$, or the standard error SE. The SE is only $\sigma/\sqrt{n} = 10/\sqrt{100} = 1$

So $z = \frac{\bar{X}-150}{1}$

2. Find the area under the standard Normal curve to the right of z.

Example I: Find the P-value associated with $\mu \leq 150$ for different values of $\bar{X}$ (there's no change to the SE). I did the first.

$\bar{X}$ = 152	Z = 2	P-value = .023
$\bar{X}$ = 151	Z = ?	P-value = ?
$\bar{X}$ = 150.5	Z = ?	P-value = ?
$\bar{X}$ = 150	Z = ?	P-value = ?

Negative z-values: What if $\bar{X}$ < 150 results in z being a minus number? Say $\bar{X}$ = 149, so z = -1. Pr(Z $\geq$ -z) =1 – Pr(Z < -z), and because of symmetry of the Normal distribution, Pr(Z < -z)= Pr(Z > z). So the P-value is 1 – Pr(Z > z) = 1 -.16 = .84.

Don't worry, you can use the SEV app by Richard Morey.

The Morey SEV app. Go to *sampling distribution* (although the *curve selection* is also very informative)
Change the sampling mean to be the observed $\bar{X}$. When asking for the P-value, ignore the *alternative* (it's imagined to be a Fisherian test with just the null for this purpose), and ignore the *alpha level* box which is for power in a N-P test. Then, under *display options* ask for the *P-value*.

It's useful also to go to the *curve selection* to see the P-value. (Keep the arrow choice to >, although you can also use it for < problems.)

Example II: Now fix $\bar{X}$ = 152, and find P-values associated with testing 3 different null hypotheses: $\mu \leq 151$, $\mu \leq 152$, $\mu \leq 153$
For $\mu \leq 151$

$z = \frac{\bar{X}-151}{1} = \frac{152-150}{1}$ = 1

(a) If you were testing

$H_0: \mu \leq 151$ vs. $H_1: \mu > 151$,

the P-value would be .16. Now you do the other two:

(b) For $\mu \leq 152$,

$z = \frac{\bar{X}-152}{1}$ so the P-value is _______ if you were testing

$H_0: \mu \leq 152$ vs. $H_1: \mu > 152$,

(c) For $\mu \leq 153$,

$z = \frac{\bar{X}-153}{1} =$ ____ so the P-value is ____ if you were testing

$H_0: \mu \leq 153$ vs. $H_1: \mu > 153$,

Getting these P-values using the Morey app. The sample mean remains FIXED at $\bar{X}$ = 152, and the *alternative* and the *alpha score* boxes are irrelevant (it can be done in different ways, but let's just stick with one way). The ONLY thing you change is the value for the null μ . Then under display option click P-value (it's lower case in the app). You can do it by means of the *sampling distribution* display or the *curve selection*. The sampling distribution display also provides the reasoning at the bottom

Severity. The severity associated with $\mu > \mu'$. (see SIST p. 143)
Using the Morey app: Set the sample mean $\bar{X}$ and change ***the alternative value for μ to μ'.***
This alternative will be some discrepancy from the null value under test but, for simplicity, this computation app for severity does not pick up on changes you make to the *null box*—that is assumed fixed. Nor does it pick up on changes to the *alpha-level box,* used in N-P tests.
Then under *display option click severity* using either the *sampling distribution* display or the *curve*. The *sampling distribution* display also provides the reasoning at the bottom. The *curve* supplies SEV values for other discrepancies, so it's especially useful.

Compute the SEV values for the examples in Table 3.1, SIST p. 144. Here $\bar{X}$ = 152
Notice that in each case the SEV value for inferring $\mu > \mu'$ corresponds to 1 – the P-value associated with testing $\underline{\mu < \mu'}$ with this observed sample mean $\bar{X}$.