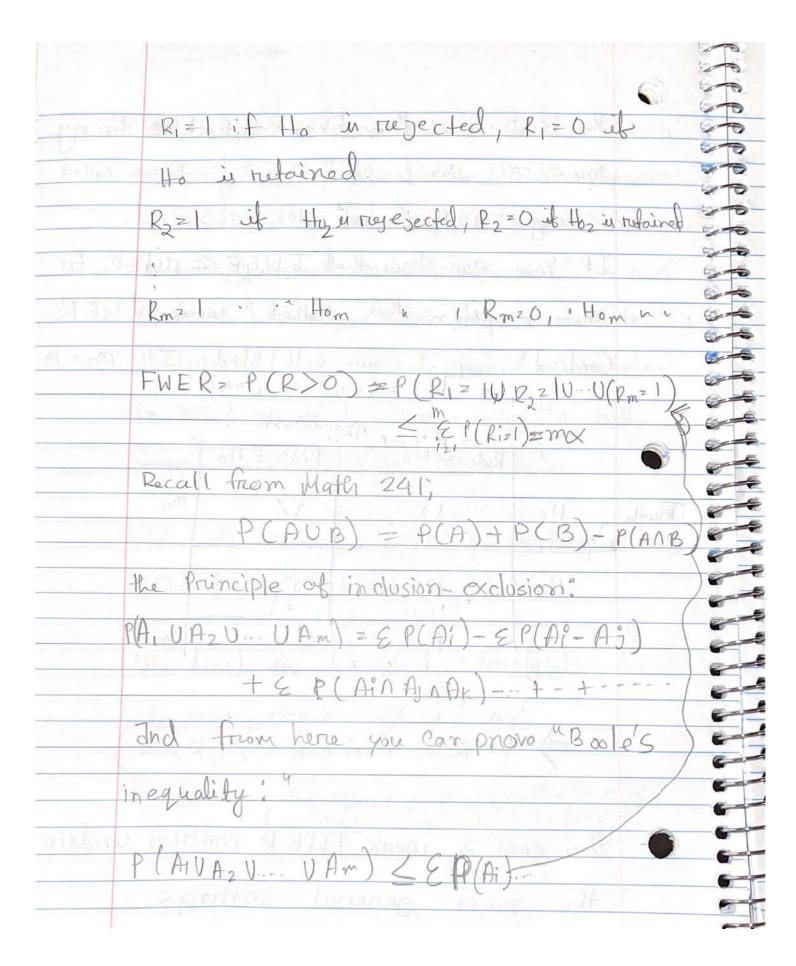
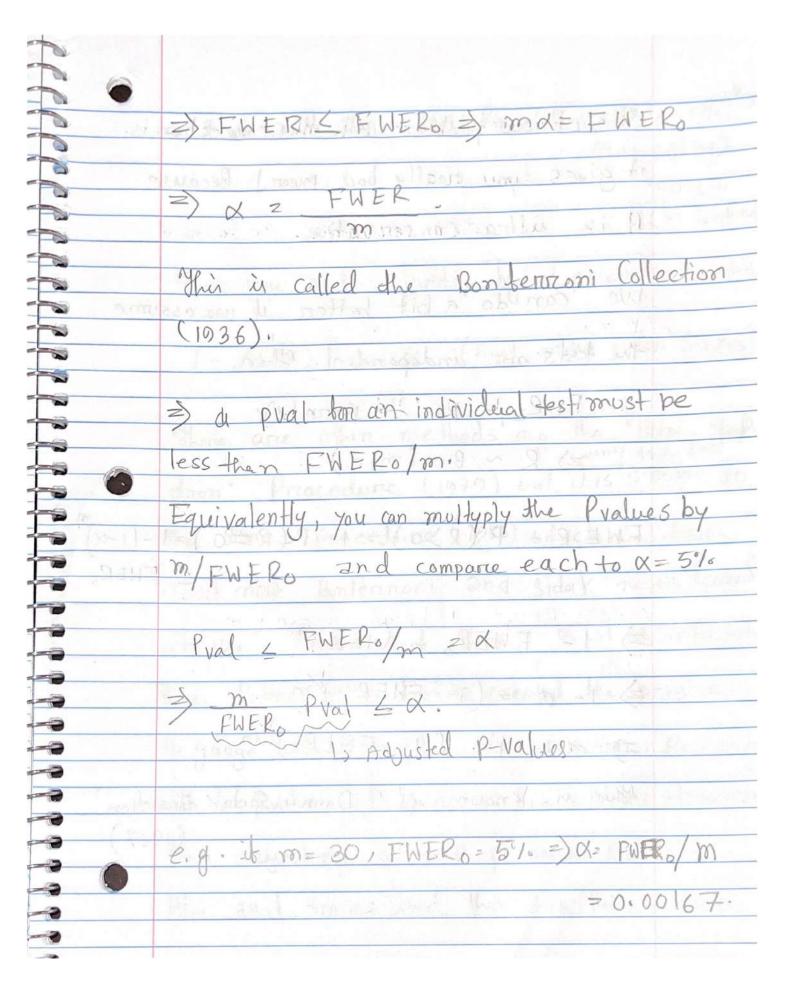
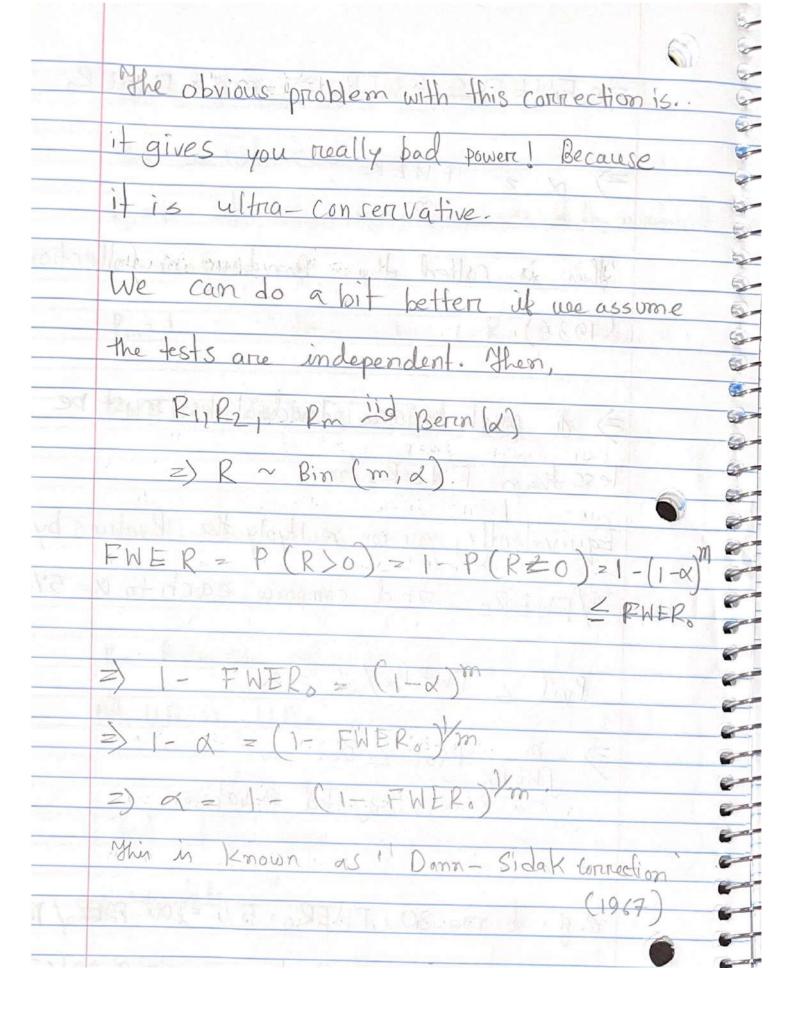
lecture 18 % The entire set of mests is called a "family" A family is any logical collection of inferences for which it is meaningful to take into account Some combined measure of error on a set of tests where you wish to prevent ! data driedging" (e.g. the spurious convulations in 342) ore to " ensure a connect overall' decision in the collection of tests We will discuss 2 prirror properties/metrics forca family at tests. The first to is called ! family wise ennon rate " (FWER) defined as; WER: 2 P(V) o) & FWEP of level of Centrial Hart I chose e.gs/

- 4	You can Show that FWERE FWERD ton any				
	mo & m. subsit of the on tests, this is called				
0 0	100				
80-closes	Strong FWER Control We won't study it.				
	If You can show that FWER & FWER OF				
	mo = m then this called " weak IF WER				
Al sul	Control 1 we will Study. If mo = m.				
27	The state of the s				
	Retain Ho Reject Ho				
1	430 5	alla Jatalan 18	ake exact	Maria La ha	
Truth	Ho		V	Mo	
P. Carlotte		TE COLUMN TO AR	TARE JURIE	1 4 8 60 21 29 32 20 1	
X	Ha	ho orinhai	le Goldionis	Ont	
4 17	A - 14 11	2-11/pm 3 = 1	pill del	m	
4:	A - SALE / JAZAKIN I A D +				
1					
7 5,0	=> V=R=> (WER=P(R>0)				
1	The set of the second				
	Our goal is weak FWER control under				
	the most general settings.				







m = 30, FWER0 = 5 1/0 = X= higher power with Sidek First order tylon Serdes but it is similar to the simes procedure 1986) which we ta mow Bonfermoni and sidak never looked Pralue and there's a lot Remember, Fisher executed the p-value to gauge the "strungth" of a rejection. Rejecting with a p-value of 0.00001 is much stronger than rejecting with a pt value Hom and simes used this For this

p-values Pip Pm order statistics min pralue max pvalue. ocate max doesn't Priore Contro " it is Trove more powertou Bon Fermoni/ Sidal.

Construction you reject all fests up to the if the tests are in order The Problem with FWER in Genera is maybe it's too conservative what it you to trade some false rejections fore morre powers? Let S consider another metric of familywise control (not FWER), called I False discovery Rate (FDR). firest False discovery proportion (FDP) , proportion of rujections that any type Temons

H E	
Man Man	FDR: 2 E [FDP], the expected proportion
	The proportion
Thesta	trejections that are
	Type Terriora.
	Now we wish to control FDR some
	FDR & FDR. 1 a Constant you set.
Mara /	For example of FDR, 25% and
not you	I run m tests and get 100 rejections,
A101 2 770	Then I except \$ 5 of the neverting
Sinhen	to be type I enous = 95 at the rejections
Balla	to be do real discovenier.
1-N	Wole: Im = mo the FWER=FDR.
[\$(14] a)	Proof:
18 4	m = m = > V2 R = ) [ OP=   1 4 R> 0   F(A) &
1/=189	Ben (P(R>0))

Z FDRZE FOP Z P(R) O) Z FWER the FDR procedure in more powerful than the FWER procedure. 1 W/2 0 120 3 0 20 V2 2) 1 > 10 R/2 OR/3. +R 17/12) 17/00 / 1 AB 1 V >1 > 1 /2 VZI) ZFDR FWER >, FDP Ben Jamini and Hoch Berg (1995) Prioved the simes-procedure controls FOR turany Mo subset of mests.

FDR = mo/m FDRo & FDRo thus forc

a small mo (which you don't observe),

the FDR control is much better than FDRO