Miscellaneous Handouts

2016 AP Statistics APSI

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Make it Stick: the Science of Successful Learning

By Peter C. Brown

1. Learning must be e_________________ to be lasting.

2. We are easily f_______________ about our learning.

3. R______________ practice is better than rereading;

4. …so is s_______________ and i____________________ practice.

5. "Solve before taught" leads to deeper learning (g_______________)

6. "Learning styles" theories are n______ s________________ by empirical research

7. It is better to a__________ i_____________________ with subject

8. I____________________ theories have some support

9. E_______________ u_______________ p_______________…(good)

10. E____________________ is a good learning tool

11. F_________________ can feel like learning; (s______________ does NOT feel like learning)

12. Learning needs a p___________ f________________________.

Brown, Peter C. Make It Stick. the Science of Successful Learning. Cambridge, MA: Belknap of Harvard UP, 2014

#1 Best Seller in Educational Psychology (Amazon) $9.78 (Kindle Edition)

America's Wait Problem

→ BY MICHAEL ROSENBERG

→ **Tim Hudson stood** in the Giants' clubhouse Sunday, talking about pitching in his first World Series in a 16-year major league career, and he knew he was lucky. Fans in Section 334, in the upper deck in leftfield of AT&T Park, had traveled all the way from Kansas City to San Francisco just to chant "Let's Go, Royals!" After a 28-year World Series drought, they knew they were lucky too.

But did anybody realize *how* lucky?

Championship droughts are not what they used to be. They are longer, drier and more painful. Every major sports league has expanded to at least 30 teams, but they all still only give out one championship trophy per season. In many cities sports fans will be on hold. Enjoy the music while your party is delayed.

We made such a big deal of Kansas City making the playoffs for the first time since 1985 because it's been a really long time, and for most of that stretch the Royals were terrible. There were moments when they did not seem to understand things like the infield fly rule or why home plate was where it was. A 29-year gap between playoff appearances may be unusual, but in an era of 30-team leagues, 29 years between championships is nothing.

There are 30 major league teams (and 30 in the NHL and NBA too; the NFL has 32). Let's assume leagues resist the urge to further expand. If every league distributes championships equally, the average wait for a title will be 30 years. But that's just the average wait. Factor in variables such as competence and some teams will be cooling their, say, Jets longer than others.

So how long would you have to wait for your parade? Despite my advanced math skills, I found somebody else to answer the question: Jeffrey Rosenthal, a professor of statistics at the University of Toronto and the author of the bestselling book *Struck by Lightning: The Curious World of Probabilities.*

Rosenthal completed some statistical calculations under the assumption that all 30 teams had an equal chance of winning. The result: a team would have a 25.8% chance of going without a title for 40 years, with an 18.4% chance that the drought would extend to 50 seasons. The probability of not seeing your team win another World Series before 2100 would be 5.4%.

Sound bad? Reality is worse. That model assumes all teams have the same shot. But if all things were equal, cucumbers would taste like chocolate cake. We don't live in that world. We live in a world where the Spurs somehow land both David Robinson and Tim Duncan, brilliant coach Bill Belichick finds brilliant quarterback Tom Brady, LeBron James teams up with his buddies in Miami and the Yankees charge fans $100 for Officially Licensed Used Tobacco, then spend that money on payroll. Some teams will be consistently better than others, for reasons that are mental, financial, geographical or coincidental. That sound you hear is Cubs fans crying.

We live in an era of **instant everything,** but sports fans have to wait longer than ever for their share of happiness.

In Rosenthal's model, the most likely number of champions in an 18-year span is 14. In the 18 baseball seasons before this one, 10 franchises won championships. The chance of that happening, if all teams were equal, is 1.0%.

We live in an era of instant everything, but many sports fans have to wait longer than ever for their share of happiness. Millions of us can expect to spend at least 40 years in the desert, hoping there is good Wi-Fi there.

The Royals have a young team, with more talent on the way, but that only guarantees pretty preseason predictions. And Giants fans should enjoy this era because they are unlikely to see anything like it again. The Giants went 56 years without a championship, then won in 2010 and '12 before making the World Series again this season. The 56-year wait seemed excruciating. In the future it will seem normal.

Still, you should keep hope alive, and while you're at it, keep yourself alive. Americans are now expected to live an average of 78.8 years. I'm not saying there is a good chance you will die before your favorite team wins a championship. But I strongly advise you to eat your vegetables. □

Which sports drought will end next? Join the discussion on Twitter by using **#SIPointAfter** and following **@Rosenberg_Mike**

CARLOS M. SAAVEDRA FOR SPORTS ILLUSTRATED

Can Big Data Tell Us What Clinical Trials Don't?

OCT. 3, 2014 By VERONIQUE GREENWOOD
http://www.nytimes.com/2014/10/05/magazine/can-big-data-tell-us-what-clinical-trials-dont.html?ref=magazine&_r=1

When a helicopter rushed a 13-year-old girl showing symptoms suggestive of kidney failure to Stanford's Packard Children's Hospital, Jennifer Frankovich was the rheumatologist on call. She and a team of other doctors quickly diagnosed lupus, an autoimmune disease. But as they hurried to treat the girl, Frankovich thought that something about the patient's particular combination of lupus symptoms — kidney problems, inflamed pancreas and blood vessels — rang a bell. In the past, she'd seen lupus patients with these symptoms develop life-threatening blood clots. Her colleagues in other specialties didn't think there was cause to give the girl anti-clotting drugs, so Frankovich deferred to them. But she retained her suspicions. "I could not forget these cases," she says.

Back in her office, she found that the scientific literature had no studies on patients like this to guide her. So she did something unusual: She searched a database of all the lupus patients the hospital had seen over the previous five years, singling out those whose symptoms matched her patient's, and ran an analysis to see whether they had developed blood clots. "I did some very simple statistics and brought the data to everybody that I had met with that morning," she says. The change in attitude was striking. "It was very clear, based on the database, that she could be at an increased risk for a clot."

The girl was given the drug, and she did not develop a clot. "At the end of the day, we don't know whether it was the right decision," says Chris Longhurst, a pediatrician and the chief medical information officer at Stanford Children's Health, who is a colleague of Frankovich's. But they felt that it was the best they could do with the limited information they had.

A large, costly and time-consuming clinical trial with proper controls might someday prove Frankovich's hypothesis correct. But large, costly and time-consuming clinical trials are rarely carried out for uncommon complications of this sort. In the absence of such focused research, doctors and scientists are increasingly dipping into enormous troves of data that already exist — namely the aggregated medical records of thousands or even millions of patients to uncover patterns that might help steer care.

The Tatonetti Laboratory at Columbia University is a nexus in this search for signal in the noise. There, Nicholas Tatonetti, an assistant professor of biomedical informatics — an interdisciplinary field that combines computer science and medicine — develops algorithms to trawl medical databases and turn up correlations. For his doctoral thesis, he mined the F.D.A.'s records of adverse drug reactions to identify pairs of medications that seemed to cause problems when taken together. He found an interaction between two very commonly prescribed drugs: The antidepressant paroxetine (marketed as Paxil) and the cholesterol-lowering medication pravastatin were connected to higher blood-sugar levels. Taken individually, the drugs didn't affect glucose levels. But taken together, the side-effect was impossible to ignore. "Nobody had ever thought to look for it," Tatonetti says, "and so nobody had ever found it."

The potential for this practice extends far beyond drug interactions. In the past, researchers noticed that being born in certain months or seasons appears to be linked to a higher risk of some diseases. In the Northern Hemisphere, people with multiple sclerosis tend to be born in the spring, while in the Southern Hemisphere they tend to be born in November; people with schizophrenia tend to have been born during the winter. There are numerous correlations like this, and the reasons for them are still foggy — a problem Tatonetti and a graduate assistant, Mary Boland, hope to solve by parsing the data on a vast array of outside factors. Tatonetti describes it as a quest to figure out "how these diseases could be dependent on birth month in a way that's not just astrology." Other researchers think data-mining might also be particularly beneficial for cancer patients, because so few types of cancer are represented in clinical trials.

As with so much network-enabled data-tinkering, this research is freighted with serious privacy concerns. If these analyses are considered part of treatment, hospitals may allow them on the grounds of doing what is best for a patient. But if they are considered medical research, then everyone whose records are being used must give permission. In practice, the distinction can be fuzzy and often depends on the culture of the institution. After Frankovich wrote about her experience in The New England Journal of Medicine in 2011, her hospital warned her not to conduct such analyses again until a proper framework for using patient information was in place.

In the lab, ensuring that the data-mining conclusions hold water can also be tricky. By definition, a medical-records database contains information only on sick people who sought help, so it is inherently incomplete. Also, they lack the controls of a clinical study and are full of other confounding factors that might trip up unwary researchers. Daniel Rubin, a professor of bioinformatics at Stanford, also warns that there have been no studies of data-driven medicine to determine whether it leads to positive outcomes more often than not. Because historical evidence is of "inferior quality," he says, it has the potential to lead care astray.

Yet despite the pitfalls, developing a "learning health system" — one that can incorporate lessons from its own activities in real time — remains tantalizing to researchers. Stefan Thurner, a professor of complexity studies at the Medical University of Vienna, and his researcher, Peter Klimek, are working with a database of millions of people's health-insurance claims, building networks of relationships among diseases. As they fill in the network with known connections and new ones mined from the data, Thurner and Klimek hope to be able to predict the health of individuals or of a population over time. On the clinical side, Longhurst has been advocating for a button in electronic medical-record software that would allow doctors to run automated searches for patients like theirs when no other sources of information are available.

With time, and with some crucial refinements, this kind of medicine may eventually become mainstream. Frankovich recalls a conversation with an older colleague. "She told me, 'Research this decade benefits the next decade,' " Frankovich says. "That was how it was. But I feel like it doesn't have to be that way anymore."

AP Exam Practice: Day 1

The tables below show the scores on the same science pretest and the same science posttest for 20 students. Of the 20 students, 8 were randomly selected from the magnet school and 12 were randomly selected from those who applied to attend the magnet school but who were not selected and then attended their original school.

Magnet School		
Pretest Score	Posttest Score	Posttest − Pretest
80	97	17
78	98	20
86	84	−2
78	79	1
64	89	25
71	77	6
71	83	12
73	88	15
$\bar{x} = 75.125$	$\bar{x} = 86.875$	$\bar{x} = 11.750$
$s = 6.770$	$s = 7.699$	$s = 9.407$

Original School		
Pretest Score	Posttest Score	Posttest − Pretest
83	80	−3
80	89	9
63	65	2
79	78	−1
83	93	10
77	79	2
66	70	4
80	84	4
73	80	7
90	90	0
77	78	1
90	91	1
$\bar{x} = 78.417$	$\bar{x} = 81.417$	$\bar{x} = 3.000$
$s = 8.207$	$s = 8.512$	$s = 3.977$

(a) Perform a test to determine whether students who attend the magnet school demonstrate a significantly higher mean difference in test scores (Posttest − Pretest) than students who applied to attend the magnet school but who were not selected and then attended their original school.

Administrators were also interested in using pretest scores on this test as a predictor of posttest scores on the test. The following computer output contains the results from separate regression analyses on the magnet school scores and on the original school scores. The accompanying graph displays the data and separate regression lines for the magnet and original schools.

Regression Analysis: Post_Magnet versus Pre_Magnet

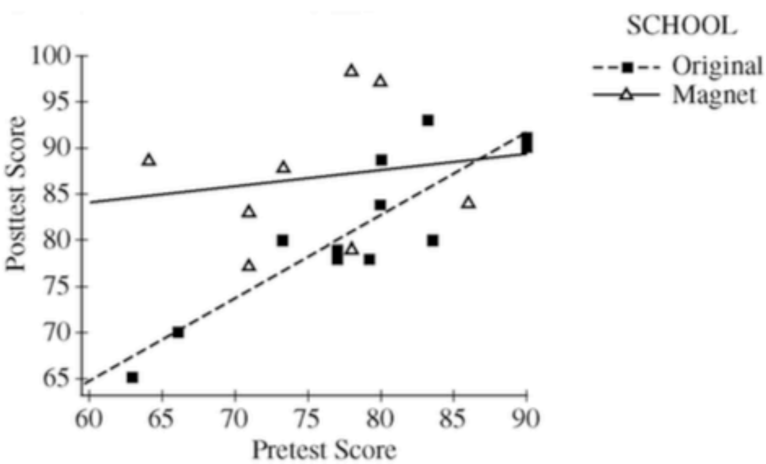
```
Predictor      Coef  SE Coef     T      P
Constant      73.27    34.55  2.12  0.078
Pre_Magnet   0.1811   0.4583  0.40  0.706


S = 8.20920   R-Sq = 2.5%   R-Sq(adj) = 0.0%
```

Regression Analysis: Post_Original versus Pre_Original

```
Predictor        Coef  SE Coef     T      P
Constant         9.24    11.91  0.78  0.456
Pre_Original   0.9204   0.1512  6.09  0.000


S = 4.11463   R-Sq = 78.8%   R-Sq(adj) = 76.6%
```



(b) (i) State the equation of the regression line for the magnet school and interpret its slope in the context of the question.

(ii) State the equation of the regression line for the original school and interpret its slope in the context of the question.

(c) To determine whether there is a significant correlation between pretest score and posttest score, a test of the following hypotheses will be performed.

H_0 : There is no correlation between pretest score and posttest score (true slope $= 0$)

versus

H_a : There is a correlation between pretest score and posttest score (true slope $\neq 0$)

(i) Using the regression output, state the *p*-value and conclusion for this test at the magnet school. Assume the conditions for inference have been met.

(ii) Using the regression output, state the *p*-value and conclusion for this test at the original school. Assume the conditions for inference have been met.

(d) What additional information do the regression analyses give you about student performance on the science test at the two schools beyond the comparison of mean differences in part (a) ?

Blocking Activity:
Can you see the trees for the forest?

This activity is a simulation of problem 4 on the 2001 AP Statistics exam. The simulation will ask you to assign trees of two varieties, a new hybrid and a standard variety, to the eight available plots in the field. You'll have the opportunity to assign the trees to the plots in three different ways: a design with no blocking, a design that uses blocking scheme A from the problem, and a design that uses blocking scheme B from the problem. Together with your classmates, your goal is to find the experimental design that has the best chance of correctly identifying which variety of tree performs best, on average.

Let's assume that the new variety really is better. In our simulation, trees of the new variety will have an average production of 53 pounds of fruit, while the old variety typically produces 47 pounds of fruit.

Ideally, designs that have a better chance of detecting the superiority of the new trees are preferred.

We'll also assume that trees planted close to the forest grow more poorly than those away. If a tree is planted toward the forest, it's production is reduced by 10 pounds, and for those away the production will be increased by 10 pounds.

Even within a variety, there is variability in the production from tree to tree. Also, individual plots in the field will have differences due to water, fertility, or other factors, adding variability in the production from plot to plot. In this simulation the variability of trees and plots will be accounted for by adding or subtracting a random quantity for each tree. The total productivity will be calculated as a sum:

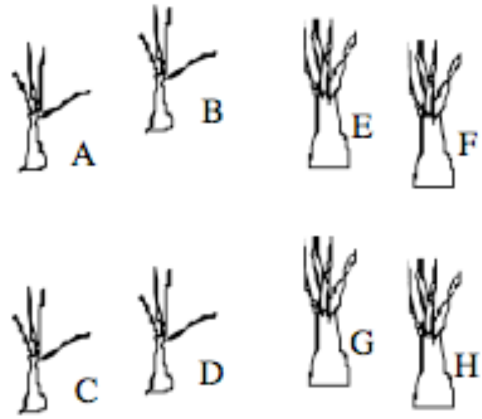
Variety (47 or 53) + Proximity to forest (-10 or +10) + Variation (Random)

Here's one way to determine the random amount to add or subtract, using a coin and a die. First flip the coin: if it's heads, the tree is a little stronger than average, tails a little weaker. How much stronger or weaker is determined by rolling the die. For example, H 3 means add 3 to the productivity of that tree, T 5 means subtract 5.

There are other methods of accounting for the differences of individual trees, including using a table of random digits or a graphing calculator. Your teacher may want you to use one of these other strategies.

Simulation 1: A completely randomized design.

(Subtract 10 in this column)	(Add 10 in this column)
1	2
3	4
5	6
7	8



Old Variety New Variety

Ok let's plant the trees! The trees have been labeled A - H. The plots are numbered 1 - 8.

To assign the trees to the plots, you can either use a table of random digits or your calculator. Using a table of random digits, select a digit, which will be the plot in which tree A is planted. If the digit is 9 or 0, ignore it and choose the next digit. Then select a digit for where to plant tree B. Since only one tree can go in a plot, if you choose the same number you had for tree A, skip this and move on. Continue in this way until all trees are planted.

Now we'll have to wait while the trees grow and the fruit ripens.

Harvest time! We need to measure the productivity of each of the trees. You'll calculate the productivity as

   Tree Variety (new = 53, old = 47)
\+ Forest position (-10 for near the forest, +10 for away)
\+ Random variation (using coin and die, or other method)

Calculate the productivity of each of your 8 trees and record this in the table above. Then calculate the average productivity of the new variety and the old variety. Record the results below, and indicate which variety was better. (As a check, these averages should be between 40 and 60.)

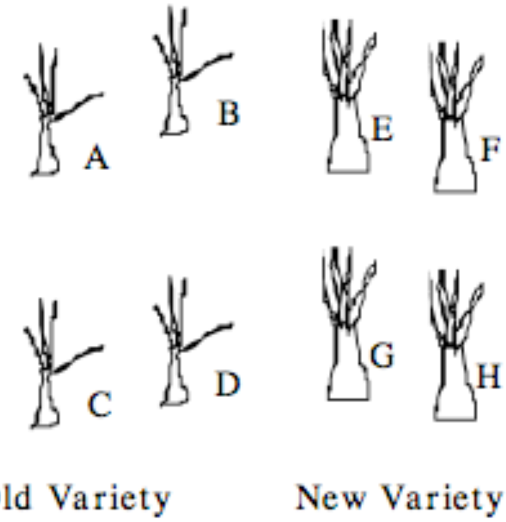
Old Average Productivity: _________ New Average Productivity: _________

Which was better? Difference (New – Old): _________

Combine your results with your classmates. How often did the new trees come out with a better result? Describe the distribution of differences.

Simulation 2: Blocking Scheme A.

Block 1, trees ABEF (Subtract 10)	Block 2, trees CDGH (Add 10)
1	2
3	4
5	6
7	8



As before, the trees have been labeled A – H and the plots are numbered 1 - 8. In this scheme, however, you need to make sure that two of each type of tree are planted in each block (column). So, make the assignments of trees A and B to the first block (keep picking digits until 1, 3, 5, or 7 is chosen), with C and D placed in the second block (must be 2, 4, 6, or 8). Do the same with the new trees: make sure that trees E and F are in block 1, G and H in block 2.

Grow, grow, grow, grow, ...

Time to harvest. You'll calculate the productivity of each tree as before:

Tree Variety (new = 53, old = 47)
\+ Forest position (-10 for near the forest, +10 for away)
\+ Random variation (using coin and die, or other method)

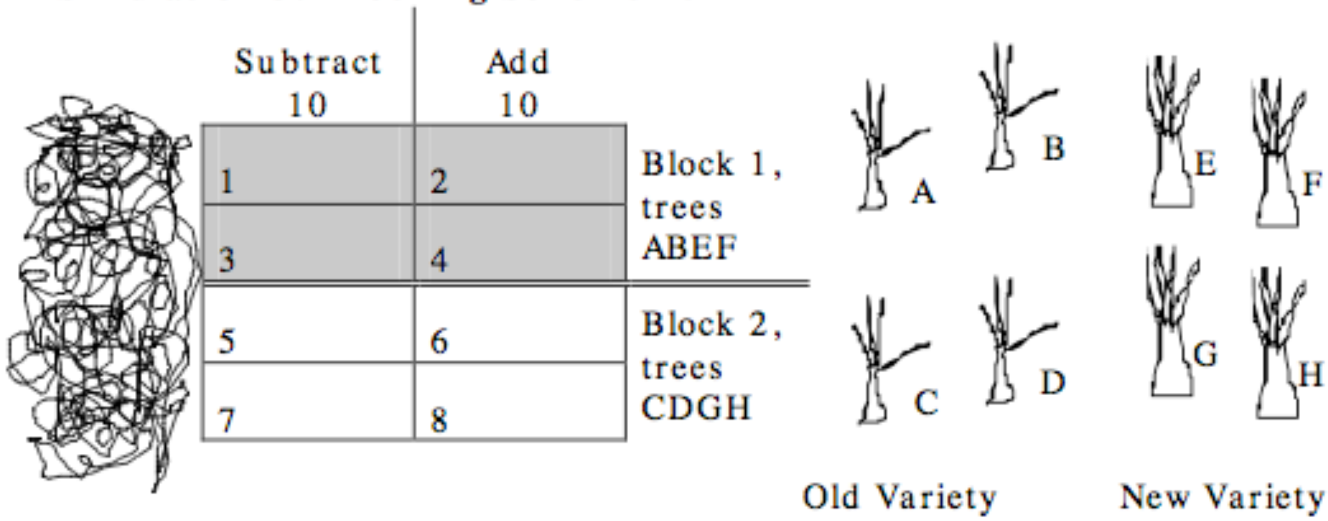
Calculate the productivity of each of your 8 trees, then calculate the average productivity of the new variety and the old variety. Record the results below, and indicate which variety was better. (As a check, these averages should be between 40 and 60.)

Old Average Productivity: _________ New Average Productivity: _________

Which was better? Difference (New – Old): _________

Combine your results with your classmates. How often did the new trees come out with a better result? Describe the distribution of differences.

Simulation 3: Blocking Scheme B.



As in the previous blocking example, you'll first assign the trees A, B, E, and F to the first block, but in this case these are the top 4 plots (shaded above). Make sure that these are assigned to plots 1 – 4. Then assign trees C, D, G, and H to the second block, plots 5 – 8.

Grow, grow, grow, grow, ...

Time to harvest. You'll calculate the productivity of each tree as before. Be careful to add or subtract the 10 pounds according to whether the tree is next to the forest or away – it doesn't vary by block in this case.

  Tree Variety (new = 53, old = 47)
+ Forest position (-10 for near the forest, +10 for away)
+ Random variation (using coin and die, or other method)

Calculate the productivity of each of your 8 trees, then calculate the average productivity of the new variety and the old variety. Record the results below, and indicate which variety was better. (As a check, these averages should be between 40 and 60.)

Old Average Productivity: _________ New Average Productivity: _________

Which was better? Difference (New – Old): _________

Combine your results with your classmates. How often did the new trees come out with a better result? Describe the distribution of differences.

F.R.AP.P.Y's

(Free Response AP Problems—Yay!)
(Problems can be found on StatsMonkey web site)

"FRAPPYs are not simply a test-preparation tool or a you-do-the-problem-and-I'll-grade-it-and-give-it-back-to-you exercise. The FRAPPY is an assessment FOR learning whose purpose is to provide students feedback and a means for self-reflection on their conceptual understanding as well as help them develop their communication skills. The students are the critical component...they not only do the problem, but they also become an AP Reader and evaluate their performance as well as that of others."

--Jason Molesky

1) Hand out FRAPPY! and give **12-15 minutes** to complete.

2) Then students turn their response over and briefly **discuss the "Intent** of the Question" from their perspective. Ask, "What do you think this question was getting at? What statistical concept or ability are they asking you to display?"

3) **Show 2-3 student responses and** have pairs of kids **classify them** as Minimal, Developing, Substantial, or Complete. Discuss why they classified them that way. What did/didn't the sample responses do? Note, they have NOT seen the rubric at this point. In a sense, they are developing it on their own.

4) Hand out and discuss the **actual scoring rubric**.

5) Have students pair up and **grade each other's responses**.

6) **Have students reflect** on what they would do differently to improve their response on similar questions. File away for AP review later...

"FRAPPY"

{Free Response AP Problem...Yay!}

The following problem is taken from an actual Advanced Placement Statistics Examination. Your task is to generate a complete, concise statistical response in 15 minutes. You will be graded based on the AP rubric and will earn a score of 0-4. After grading, keep this problem in your binder for your AP Exam preparation.

As dogs age, diminished joint and hip health may lead to joint pain and thus reduce a dog's activity level. Such a reduction in activity can lead to other health concerns such as weight gain and lethargy due to lack of exercise. A study is to be conducted to see which of two dietary supplements, glucosamine or chondroitin, is more effective in promoting joint and hip health and reducing the onset of canine osteoarthritis. Researchers will randomly select a total of 300 dogs from ten different large veterinary practices around the country. All of the dogs are more than 6 yeas old, and their owners have given consent to participate in the study. Changes in joint and hip health will be evaluated after 6 months of treatment.

Scoring:

(a) What would be an advantage to adding a control group in the design of this study?

E P I

(b) Assuming a control group is added to the other two groups in the study, explain how you would assign the 300 dogs to these three groups for a completely randomized design.

E P I

(c) Rather than using a completely randomized design, one group of researchers proposes blocking on clinics, and another group of researchers proposes blocking on breed of dog. How would you decide which <u>one</u> of these two variables to use as a blocking variable?

E P I

Total:__/4

Student Responses for Dogs' Hip Health Problem

(a) What would be an advantage to adding a control group in the design of this study?

An advantage to adding a control group to this design would be that it gives the experiment something to compare its results to. to see how much of a difference the treatments make.

(b) Assuming a control group is added to the other two groups in the study, explain how you would assign the 300 dogs to these three groups for a completely randomized design.

For every dog that is chosen roll a die. If the die is a 1 or 2 give the dog the glucosamine. If the die is a 3 or 4 give the dog the chondroitin. If the die is a 5 or 6 put the dog in the control group. This will completely randomize the design.

(c) Rather than using a completely randomized design, one group of researchers proposes blocking on clinics, and another group of researchers proposes blocking on breed of dog. How would you decide which <u>one</u> of these two variables to use as a blocking variable?

I would decide to use the blocking on breed of dog. The clinic the dog is in should not affect the medicine the dog is given. However, different breeds of dogs might respond to the medicines differently. Therefore, the blocking on breed of dog should be used.

(a) What would be an advantage to adding a control group in the design of this study?

The advantage to adding a control group in the design of this study would be to have something to compare the results to. This helps to reduce the effects of confounding variables. For example the weather which can affect joint pain.

(b) Assuming a control group is added to the other two groups in the study, explain how you would assign the 300 dogs to these three groups for a completely randomized design.

To obtain a compleatly randomized design I would number each dog 1 to 300 and then using a random number generator I would select 100 numbers ignoring repeats the 100 dogs corresponding to those 100 numbers will be placed in the first treatment group and will recieve glucosamine. I will repeat this process selecting 100 new numbers, these 100 dogs will be placed in the second treatment group and will recieve chondroitin and the remaining 100 dogs will be the control group and will recieve a placeb.

(c) Rather than using a completely randomized design, one group of researchers proposes blocking on clinics, and another group of researchers proposes blocking on breed of dog. How would you decide which <u>one</u> of these two variables to use as a blocking variable?

Which ever variable has more variation should be used as a block. I think breed of dog will cause more variation in the experiment because different kinds of dogs can respond differently to the treatment, but which clinic the dogs came from probably will have less effect on the experiment.

(a) What would be an advantage to adding a control group in the design of this study?

It would be an advantage to add a control group to this study because then after 6 months, you have ~~some~~ a group to compare with the treated dogs in the study, to see if the treatments really had an impact in promoting joint and hip heath and reducing the onset of canine osteoarthritis.

(b) Assuming a control group is added to the other two groups in the study, explain how you would assign the 300 dogs to these three groups for a completely randomized design.

For a completely randomized design, I would assign each of the 300 dogs a number, 1-300, and then put all the numbers into a hat. Then draw 100 numbers out of ~~a~~ the hat and assign them to group 1, the control group. Then pull out 100 more numbers and assign them to group 2, the glucosamine treatment. Then with the 100 left over dogs assign them to group 3, for the chondroitin treatment. That way, you will have three groups for a completely randomized design.

(c) Rather than using a completely randomized design, one group of researchers proposes blocking on clinics, and another group of researchers proposes blocking on breed of dog. How would you decide which <u>one</u> of these two variables to use as a blocking variable?

Rather than using a completely randomized design, I would encorporate blocking on the specific breed of dog, because the different treatments could possibly have a different effect on the different types of dogs, therefore I would use the blocking on breed of dog so it would eliminate any variables that could change the actual data. I would rather block on breed of dog than clinic, because breeds of dogs seem to be much more different than different clinics, therefore I would block on breeds of dogs.

APSI Homework: Design

****Focus your attention on Part (c).**

In order to monitor the populations of birds of a particular species on two islands, the following procedure was implemented.

Researchers captured an initial sample of 200 birds of the species on Island A; they attached leg bands to each of the birds, and then released the birds. Similarly, a sample of 250 birds of the same species on Island B was captured, banded, and released. Sufficient time was allowed for the birds to return to their normal routine and location.

Subsequent samples of birds of the species of interest were then taken from each island. The number of birds captured and the number of birds with leg bands were recorded. The results are summarized in the following table.

	Island A	Island B
Number Captured in Subsequent Sample	180	220
Number with Leg Bands in Subsequent Sample	12	35

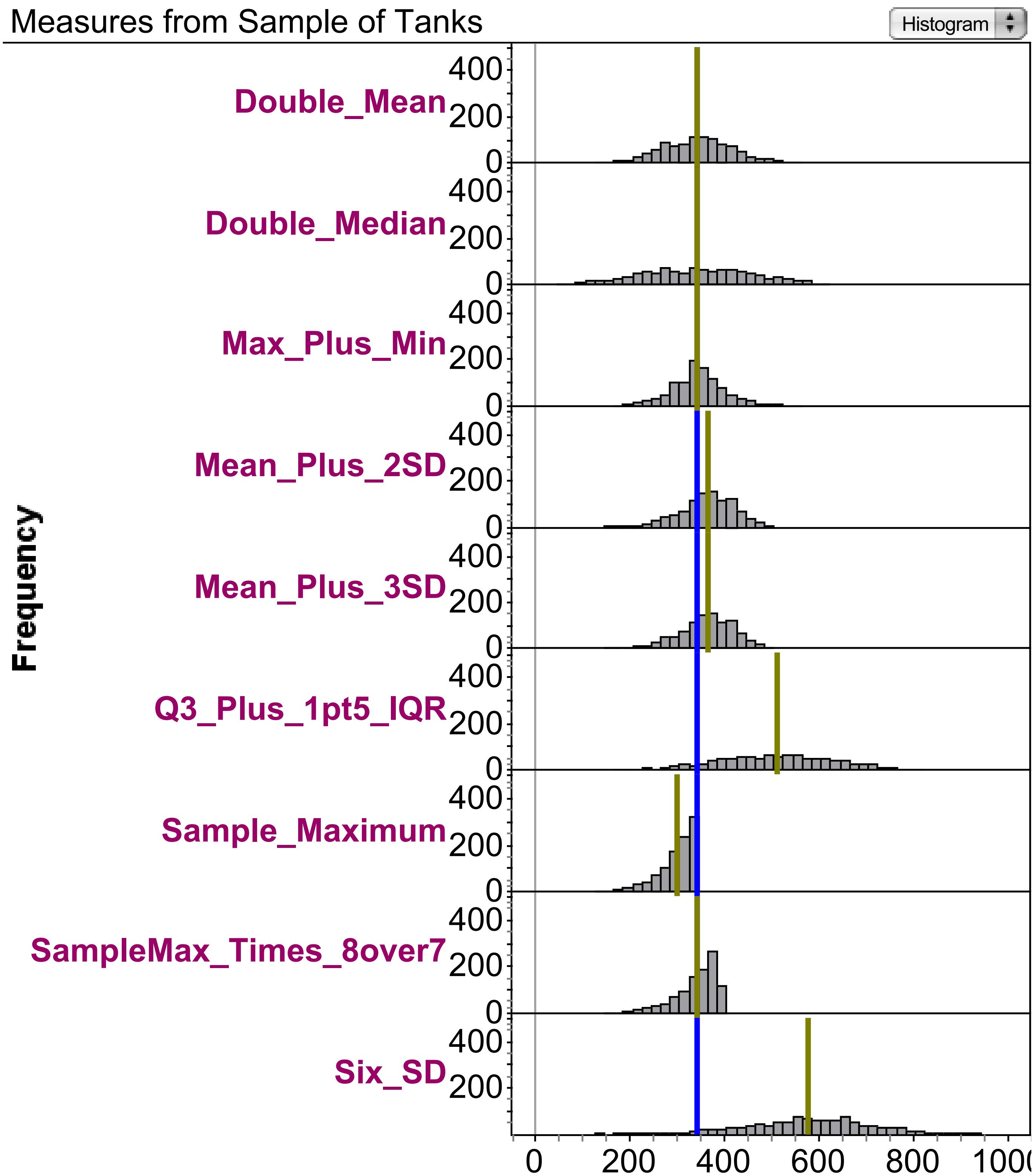
Assume that both the initial sample and the subsequent samples that were taken on each island can be regarded as random samples from the population of birds of this species.

(a) Do the data from the subsequent samples indicate that there is a difference in proportions of the banded birds on these two islands? Give statistical evidence to support your answer.

(b) Researchers can estimate the total number of birds of this species on an island by using information on the number of birds in the initial sample and the proportion of banded birds in the subsequent sample. Use this information to estimate the total number of birds of this species on Island A. Show your work.

(c) The analyses in parts (a) and (b) assume that the samples of birds captured in both the initial and subsequent samples can be regarded as random samples of the population of birds of this species that live on the respective islands. This is a common assumption made by wildlife researchers. Describe two concerns that should be addressed before making this assumption.

German Tanks Sampling Distribution Simulations



342 = 342

mean ( ) = 387.769

Tommy John and Errors

Famous pitcher Tommy John once made three errors on a single play: he bobbled a grounder, threw wildly past first base, then cut off the relay throw from right field and threw past the catcher.

In a scientific paper describing a clinical trial comparing a new pain drug with a placebo, the authors wrote something like this: “Although there was no difference in baseline age between the groups ($p = 0.458$), controls were significantly more likely to be male ($p = 0.000$).”

This statement is worse than Tommy John’s worst day because there are actually four errors in this sentence (or maybe even 4½). See if you can find them.

Exploring data

1997 #1	2000 #3	2001 #1, 6a
2002 #1	2002 B #5, 6c	2003 #1ab
2004 #1	2004B #5a	2005 #1a, 2d
2005B #1	2006 #1	2006B #1
2007 #1ab	2007B #1	2008 #1
2008B #1a	2009 #1ab	2009B #1
2010 #6ab	2010B #1	2011B #1
2012 #3a	2013 #1a, 6	2013S #1a
2014 #1ab, #4a	2014S #1, 5a	2015 #1

Normal distribution

1998 #6a	1999 #4	2000 #6d
2002 #3a	2003 #3ab	2004B #3ab
2005B #6b	2006B #3ac	2008B #5bc
2009 #2a	2011 #1	2013 #3a
2014 #3a		

Regression

1998 #2, 4	1999 #1, 6c	2000 #1
2002 #4	2002 B #1	2003 B #1
2005 #3	2005B #5ab	2006 #2ab
2007 #6abde	2007B #4	2008 #4ab, 6b
2008B #6abd	2010 #1b	2010B#6abe
2011 #5abc	2011B #6ab	2012 #1
2013S #4a	2014 #6	2015 #5

Transformations for linearity

1997 #6	2004B #1	2007B #6cd

Designing surveys and experiments

1997 #2	1998 #3	1999 #3
2000 #5	2001 #4	2002#2
2002 B #3	2003 #4	2003 B #3a
2003 B #4abd	2004 #2, 3d, 5b	2005 #1bc, 5ac
2004B #2, 6c	2005B #3	2006 #5
2006B #5, 6f	2007 #2, 5a	2007B #3
2008 #2	2008B #4a	2009 #3
2009B #4, 6a	2010 #1a, 4c	2010B #2
2011 #3	2011B #2	2012 #5c, 6a
2013 #2, 5a	2013S #3ab, 5c	2014 #4b
2014S #2		

Probability

1997 #3	1999 #5	2002 B #2
2003 B #2, 5a	2004 #3bc, 4a	2005B #6c
2006 #3b	2009B #2	2010B #5abc
2011 #2, 6b	2011B #3ab	2014 #2ab, #3c
2014S #4a		

Random variables

1999 #5	2000#6bc	2001 #2
2002 #3	2002 B #2	2003 B #5b
2004 #4bc	2004B #6b	2005 #2abc
2005B #2	2006 #3a	2007B #2a
2008 #3	2008B #5a	2012 #2
2013 #3b	2013S #3c	2014S #4bc
2015 #3		

Binomial/geometric & simulations

1998 #6bcde	2001 #3	2003 #3c
2004 #3a	2005B #6d	2006B #6c
2007B #2b	2008B #2	2009 #2b
2010 #4ab	2010B #3	2011B #3c
2013 #5c	2013S #6cd	2014 #2c

CLT & Sampling Distributions

1998 #1	2004B #3cd	2006 #3c
2006B #3b	2007 #3	2007B #2c
2008B #3	2009 #2c	2010 #2
2011B #6cd	2013S #5ab	2014 #3b
2014S #6bcde	2015 #6	

Inference with t for μ

1997 #5	1999 #6ab	2002 B #6a
2000 #2, 4	2001 #5	2002 #5
2003 #1c	2003 B #4	2004 #6
2004B #4, 5bc	2005 #6	2005B #4
2006 #4	2006B #4	2007 #1c, 4
2007B #5	2008 #6a	2008B #1b-3-4b-6c
2009 #4, 6a	2009B #5	2010 #5
2010B #4	2011 #4	2012 #3b, 6b
2013 #1b	2013S #1b	2014 #5
2014S #3, 6a		

Inference with z for p

1997 #4	1998 #5	2000 #6
2002 #6abd	2002 B #4	2003 #2, 6
2003B #3b, 6	2004B #6a	2005 #4, 5b
2005B #6a	2006B #2, 6abde	2007 #5bcd
2007B #6a	2008 #4c	2009 #5
2009B #3, 6b	2010 #3	2010B #4
2011 #6a	2011B #5	2012 #4, 5
2013 #5b	2013S #2, 6ab	2015 #2, 4

Chi-Square

1999 #2	2002 #6	2002 B #6b
2003 #5	2003 B #5c	2004 #5a
2008 #5	2009 #1c	2010B #5d
2011B #4	2013 #4	2014 #1c
2014S #5bc		

Inference for Regression

2001 #6c	2005B #5c	2006 #2c
2007 #6c	2007B #6b	2008 #6c
2011 #5d	2013S #4bc	

Stretching into something new!

2006 #6	2008 #6d	2009 #6bcd
2009B #6cde	2010 #6cde	2010B #6cd
2011 #6cd	2011B #6ef	2012 #6cd

20XXS = 20XX Secure exam released in Audit

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