Question 1

One often hears scientists proclaim, “extraordinary claims require extraordinary evidence”. Select those options below that best express why this is so.

A. Confirmation bias requires it.
B. If an extraordinary claim were to be true, then some aspect of well-established science would require revision.
C. Scientists always require extraordinary evidence for any claim, not just extraordinary ones.
D. Scientists have their own hypotheses for some unusual event or observation, so any claim to the contrary will require more than just evidence, but extraordinary evidence, to change their mind.
E. Such claims typically fly directly in the face of our current understanding of the world, an understanding obtained from an extraordinarily large body of evidence.

Extraordinary claims requiring extraordinary evidence was described in Chapter 2 of the textbook. This question specifically refers to points 7 and 9 of the concept quiz at the end of Chapter 2. Students were specifically asked to “pay close attention” to this “concept quiz” in video 1.5 and in the detailed notes.

Choice A refers to “confirmation bias”. This is a totally unrelated to the question. It was also described in Chapter 2, page 17 of the textbook, and is one of the nine points (point 5) in the concept quiz for that chapter.

Choice B is a **correct** option.

Choice C is not correct. If claims are not extraordinary, then only regular evidence is required as part of the scientific method.

Choice D is not correct. This statement implies that the scientific community is biased towards personal explanations for which there is no evidence (a hypothesis is a speculative explanation, as yet with no evidence).

Choice E is a **correct** option.

Question 2

When scientists gather empirical evidence to support a hypothesis, which role is observation best described to be taking on here?

A. Developing an explanation to an as yet mysterious and unexplained phenomenon.
B. Ensuring that the observations haven't been contaminated by expectation or belief.
C. Help figure out what's relevant to the phenomenon.
D. Testing.
E. All of the above options.

This question is referring to the 3 rolls observation plays in any scientific inquiry. It was discussed in video 1.5 and the detailed notes.

Choice A is not correct because it refers to "an as yet mysterious and unexplained phenomenon", but the question is about scientists gathering evidence to support a hypothesis. Thus an explanation for the phenomenon has already been offered, and evidence is now being sort to test it.

Choice B is not correct because this is one of the five considerations that need to be addressed when making proper scientific observations, i.e., it is not a role that observation plays. This was also discussed in video 1.5, with an example of it in video 1.6, as well as the corresponding sections of the detailed notes.

Choice C is not correct because we are not looking to figure out anything about the phenomenon at present. We have an explanation already, and we are now testing it by gathering evidence for the explanation.

Choice D is the **correct** option, as should now be clear from the explanations for choices *A* and *C*.

Choice E is not correct because choices A – C are not correct.

Question 3

In Copernicus' model of the solar system, all the planets moved in perfectly circular orbits and with uniform speed around the sun. This resulted in predictions of planet positions no better than Ptolemy's. Which of the following concerns did Copernicus not properly address when producing his model of the solar system?

A. Do we have a clear sense of what the relevant phenomena are?
B. Do we know for sure what is based on fact and what on conjecture or assumption?
C. Have our observations been contaminated by expectation of beliefs?
D. Have we considered any necessary comparative information?
E. Have we found a way to ensure we have not overlooked anything in the process of making our observations?

This question deals with the beginning of the scientific revolution, video 1.7, and video 1.5 regarding the 5 concerns, which are all listed as the 5 options in this question.

<u>Choice A</u> is not correct, because Copernicus had a very clear sense of what was relevant in the data he had – the positions of the heavenly bodies in the sky throughout the year. Both his and Ptolemy's models of the solar system were all about explaining and predicting those positions.

<u>Choice B</u> is a **correct** option. Unlike Kepler, Copernicus just assumed that heavenly bodies must move in perfect circular orbits with uniform speed just like Ptolemy as discussed in video 1.7.

<u>Choice C</u> is a **correct** option. Copernicus didn't make many observations. Most of his data was recorded by others and he took them all at face value assuming there were all good and accurate.

<u>Choice D</u> is not correct. There are no comparative observations of relevance here to not properly address.

<u>Choice E</u> is not correct. Copernicus had all the relevant data of the time, i.e., the positions of the heavenly bodies, there was nothing to overlook.

Question 4

Choose the option below that produces an incorrect statement:

Anomalous phenomena are important in science because…

A. …their resolution can lead to entire new fields of scientific study.
B. …their resolution can lead to new insights and understanding of nature.
C. …their resolution can lead to new instrumentation or experimental methods to study nature, allowing further new discoveries to take place.
D. …their resolution demonstrates the infallibility of well-established scientific theories.
E. …their resolution provides an excellent test of what is generally accepted to be true.

Anomalous phenomena are discussed in Chapter 2, page 18 of the textbook. This question specifically refers to point 8 of the concept quiz at the end of Chapter 2. Students were specifically asked to “pay close attention” to this “concept quiz” in video 1.5 and in the detailed notes. Anomalies are also mentioned in other places throughout the 4 lectures.

Choices A – C and E all produce correct statements. The incorrect statement is…

<u>Choice D</u> is the **correct** option because it produces an erroneous statement. It is an incorrect statement because well-established scientific theories are not infallible. They can be overturned (and have been), or modified, if solid evidence requires it.

Question 5

Question on the CRAAP test. Not examined in the current curriculum.

Question 6

Which invention had the greatest impact on society during the industrial revolution?

A. Blast furnaces (for iron production)
B. Steam engine
C. Steam power pumps to allow more coal to be mined
D. Steam powered machines used in factories
E. Steam powered vehicles for transporting goods

This question is referring to the industrial revolution discussed extremely briefly in video 1.8 and the detailed notes. All of the inventions had a significant impact on society during the industrial revolution. This list gives machines powered by the steam engine, with the steam engine itself being at the root of all of them. Therefore, the steam engine must be the invention with the *greatest* impact from the list, i.e., choice *B* here.

Question 7 (revised for consistency with the current BDTK)

Consider rule 3 of the Baloney toolkit: "Is the claimant providing positive evidence?". Which statement best characterises what it means?

A. "Cherry picking" evidence supporting the claim.
B. Data, that clearly constitutes evidence, only comprising positive numbers.
C. No trace of any physical evidence indicating a coverup.
D. Undeniable physical evidence that refutes alternative explanations.
E. Undeniable physical evidence that supports the claim.

The Baloney Toolkit was given in video 2.3, discussed during workshop 1, and applied during lecture 2. This particular rule is referring to evidence being the *presence* of something, not the absence of something – not something missing.

Choice A is not correct. This option is not about this rule. It is referring to the unscientific and unethical practice of selectively choosing evidence for something and completely ignoring evidence against it. In science all relevant evidence MUST be considered, nothing can be ignored.

Choice B is not correct. The word "positive" in "positive evidence" has nothing to do with the sign of a number.

Choice C is not correct. Absence of evidence in NOT evidence of absence. Finding no evidence can mean many things, e.g., one hasn't looked in the right places yet, or that the explanation is actually wrong, and there is no evidence for it to find. It does not follow that no evidence (yet) is evidence for a coverup. If there was a coverup, then positive evidence for it will exist and must be obtained.

Choice D is not correct. This is negative evidence for a claim. Showing alternative explanations are false does not provide positive evidence for another explanation. Very often there can be very many explanations for a phenomenon. Eliminating all but one doesn't prove the one remaining must be true because you may not have (read: probably haven't) thought of *all* possible explanations.

Choice E is the **correct** option.

Question 8

Select the two options that make population predictions most uncertain.

A. How many adults will survive to become elderly
B. How many children will be born
C. How many children will survive to become adults
D. How the fertility rate will change moving forward into the future
E. Mortality rates

This question was addressed Mr John Wilmoth, the Director of the UN Population Division, in video 2.4 starting at 27:35. In it he clearly states that predicting the adults of today surviving to become older people is fairly predictable. He states mortality is highly predictable and that predicting how many children surviving to become adults is also highly predictable. He also states that how many children there will be born is the hardest part.

Choice A is not one of the two most uncertain based on above.

Choice B is a **correct** option based on above.

Choice C is not one of the two most uncertain based on above.

Choice D is a **correct** option as fertility rates moving forwards in time is literally about how many babies expected to be born per woman.

Choice E is not one of the two most uncertain based on above.

Question 9 (this question was for when video 2.5 was part of the curriculum, now it is optional)

We are seeing a pattern where science improves our understanding of the world, which leads to technological developments that makes life better for people. We also have noticed that there are "side effects" that, to date, have not been adequately addressed. Match the "side effect" with the development that improved the lives of people. The industrial revolution resulted in a drop in human mortality, the cost of this was _____(i)_____. The Haber-Bosch process, along with other innovations, resulted in crop yields high enough to, in principle, feed everyone. The cost of this was _____(ii)_____.

A. (i) Dependence on the application of pesticides, increasing toxins in the environment substantially.
(ii) A substantial decline of atmospheric nitrogen (N2), completely altering the critical nitrogen-to-oxygen ratio all organisms depend on.

B. (i) Dependence on burning fossil fuels, increasing CO2 in the atmosphere substantially.
(ii) Dependence on the application of synthetic fertiliser, increasing reactive nitrogen in the environment substantially.

C. (i) Dependence on burning fossil fuels, increasing CO2 in the atmosphere substantially.
(ii) A massive overproduction of Bosch resonators, increasing heavy metal pollution in the environment substantially.

D. (i) Dependence on plastic manufacturing resulting in microplastic pollution globally.
(ii) Human overpopulation.

E. (i) Massive deforestation resulting in an extinction level event.
(ii) Global temperatures increasing resulting in sea level rise.

This question is mostly dealt with in lecture 2, videos 2.5 and detailed notes. There we found that fossil fuel dependence began with the industrial revolution, and the application of synthetic fertilizer produced from the Haber-Bosch process gave us a dependence on this process. A consequence of which was there was a great deal of reactive nitrogen now present in the environment, and we spoke about its harmful effects in video 2.5 and section 2.5.3 of the detailed notes.

Choice A is not correct as pesticides didn't exist at the time of the industrial revolution, and the Haber-Bosch process has a negligible impact on the amount of N_2 in the atmosphere.

Choice B is the **correct** option for the reasons given above.

Choice C is not correct because point (ii) is just made-up nonsense.

Choice D is not correct because in point (i) plastic wasn't invented yet during the industrial revolution.

Choice E is not correct because massive deforestation did not occur as a result of the industrial revolution and the Haber-Bosch process isn't mainly responsible for global warming.

Question 10

A strong correlation has been found between (a) the number of people who drowned by falling into a pool in a particular year and (b) the number of films Nicolas Cage appeared in a particular year. The strong correlation was demonstrated for all the years from 1999 to 2009, inclusive. Can this relationship be used to predict the number of people who drowned by falling into a pool in (i) 2007, and (ii) 2022, from the number of films Nicolas Cage appeared in 2007, and will appear in 2022?

A. (i) No
(ii) No
B. (i) No
(ii) Yes
C. The correlation clearly demonstrates that Nicolas Cage's appearance in films causes people to fall into pools are drown.
D. (i) Yes
(ii) No
E. (i) Yes
(ii) Yes

This question is referring to lecture 3, video 3.2 and the detailed notes, specifically at 3.2.1.2. The question states that a "strong correlation has been found", so we need to take this as true and the question also gives the period over which this strong correlation is observed. This literally means that we can approximately determine the number of people who drowned by falling into a pool by knowing the number of films Nicolas Cage appeared in. Why? Because a correlation has been found, so it is real and exists – it's not a "fake correlation". HOWEVER, it is a nonsensical correlation, meaning that it makes no sense for Nicolas Cage's appearance in films causes people to fall into pools are drown. Because there is no causal link, there is no way you could expect this relationship to continue to hold outside of the time range given, e.g., at some point Nicolas Cage will retire and no longer appears in films but you can be sure that people will still continue to drown by falling into pools. So, while nonsensical correlations can be used to determine outcomes within their data set (the correlation is real), there's no way you should expect them to hold outside their data set without a good reason. E.g., *A* is correlated with *B* (*B* might simply be time, say, like something goes up with time), and C is correlated with B also, so A will be correlated with C, even if it's nonsensical because B links together both A and C. This isn't the case here though.

Therefore, only **option D** can be the **correct** answer here because 2007 is within the data set from 1999 – 2009, but 2022 is far outside of it and we don't have any plausible reason to expect the two properties to be linked in any way.

Question 11

A clairvoyant claims to see the future, and shows you testimonials of his many satisfied customers. You come up with 6 quite different experimental tests of his ability, and each time he replies, “My ability doesn’t work that way, I can’t predict that.” You then ask him what test you could perform? He hesitates, then answers: “No test. My ability won’t work on you.” You then ask, can someone else test you? And he says: “No, my ability doesn’t work with tests.”

(i) Is this person clairvoyant?
(ii) Is his ability of clairvoyance scientifically established, and why?

A. (i) Definitely no.
   (ii) No, it isn’t scientifically established because his ability is untestable.
B. (i) No.
   (ii) No, testimonials can be faked, altered, embellished, cherry picked etc. Not being able to test him objectively has nothing to do with it.
C. (i) Unknown.
   (ii) No, it isn’t scientifically established because his ability is untestable.
D. (i) Yes.
   (ii) No, testimonials are not scientific evidence. Not being able to test him objectively has nothing to do with it.
E. (i) Yes.
   (ii) Yes, testimonials are clear evidence of his ability. Not being able to test him objectively has nothing to do with it.

Relevant to this question is video 3.1 on scientific explanations, and video 3.4 where we have a real-world example of the “dragon in my flat” conversation. The ability of clairvoyance hasn’t been scientifically established because there is no experimental test we can perform to verify, or not, this ability. Testimonials do not constitute scientific evidence for the simple reasons that they can be trivially fabricated, falsified, plagiarized, cherry picked etc. Thus, there is no evidence for the clairvoyant ability here. As such, we cannot deduce either way whether it is real or not. We could, however, apply the Baloney Toolkit and conclude that the ability is quite unlikely, but nevertheless it isn’t certain that this person doesn’t have the ability, just unlikely. Given this discussion, the correct option is *C*.

Question 12

It is observed that the greater the pressure inside a can of coke, the greater the “fizz” you get when you open it and pour out the coke into a glass. This observation is explained by stating that the greater the pressure of a gas above a liquid, the more the gas dissolves into the liquid. We get more fizz with the higher pressure because more gas is dissolved in the coke. Which explanatory strategy best describes this explanation, i.e., when we state “the greater the pressure of a gas above a liquid, the more the gas dissolves into the liquid”?

A. Causal mechanism
B. Cause and effect
C. Function
D. Laws
E. Underlying processes

This question relates to video 3.3 and the detailed notes. We have the statement “the greater the pressure of a gas above a liquid, the more the gas dissolves into the liquid” offered as an explanation. In fact, this **is** a scientific law in chemistry, and it’s called “Henry’s Law”.

Choice A is not correct. The quoted statement is not a statement of cause and effect.

Choice B is not correct. The quoted statement is not a causal mechanism.

Choice C is not correct. The quoted statement does not mention the purpose or function of anything.

Choice D is the correct option. It is actually called “Henry’s Law”.

Choice E is not correct. No underlying process is described by the statement.

Question 13

You are home alone, and you suddenly wake up in the middle of the night by a very loud bang, similar to a door slamming closed. Use Occam's razor to choose two explanations for the phenomenon.

A. A person you were expecting to come home very late must have slammed a door.
B. The creepy person you saw earlier today at the MRT must have somehow followed you home without you noticing, got into your home, and banged a door very hard.
C. Your home is now, quite obviously, haunted, and this proves it.
D. You must have forgotten to close all the windows, so the wind blew shut an open door in your home.
E. Your neighbour's dog escaped from their home, clawed open a window in your home and got in, but the open window allowed the wind to blow shut an open door in your home.

This question relates to video 3.4, and we are asked to find the two least complex or puzzling explanations.

<u>Choice A</u> is a **correct** option as it is a very simple and plausible explanation.

<u>Choice B</u> is not correct. The explanation, while possible, seems unlikely compared to the others due to it's complexity and implausibility.

<u>Choice C</u> is not correct. The incident proves nothing of the sort.

<u>Choice D</u> is a **correct** option. It is a little more puzzling than choice A (why would the person you were expecting slam the door late at night?), but still quite plausible.

<u>Choice E</u> is not correct. Compared to the other two options selected, it is more complex an explanation.

Question 14

Although we defined physical models to be actual physical objects like a globe or a ball-n-stick chemical structure, sometimes scientists, using diagrams and figures accompanied with mathematics, describe these types of models as physical models if their diagrams and maths are being directly related to physical objects in the real world. However, according to lecture 3 we would classify this as a combination of two types of models. Select the two types below:

A. computer model
B. conceptual model
C. maths model
D. physical model
E. real world model

This question related to video 3.5 and detailed notes, and it is indeed true that sometimes scientists call physical models those models which refer to physical real-world objects.

Choice A is not correct. Computers are not involved in the question.

Choice B is a **correct** option. We discussed in lecture that diagrams and figures can be considered as conceptual representations of reality.

Choice C is a **correct** option. Mathematics is involved in the description of the model, so this must be an example.

Choice D is not correct. The question strongly implies that this is not the case.

Choice E is not correct. We did not have such a model classification in lecture 3.

Question 15

(i) You find the keys to your home missing. You could have misplaced them in your home, or lost them on the way home. You speculate that you misplaced them at home, so you search it, but can't find them. You conclude that you lost them outside, so get new keys cut. A week later a family member finds them under the sofa, where you didn't check. This is an example of what type of error?

(ii) Sometimes an experiment produces amazing results with an equally fantastic explanation. However, upon further investigation by the scientific community the amazing results and explanation are proven wrong. This is an example of what type of error?

A. (i) false confirmation
   (ii) false confirmation
B. (i) false confirmation
   (ii) false rejection
C. (i) false rejection
   (ii) false confirmation
D. (i) false rejection
   (ii) false rejection
E. None of the options above.

This question relates to video 4.1 and the detailed notes 4.1.2. Part (i) has you tossing out your hypothesis based on your test of it (searching your home), but your search wasn't thorough enough, so it was a flawed test, which led you to the wrong conclusion. That is, you falsely rejected your hypothesis. Part (ii) is a description of a claim being supported by a flawed experiment. When investigated by the scientific community, the amazing results vanish. This is an example of a false confirmation. The only choice from A – E that is (i) false rejection (ii) false confirmation is choice C, which is the correct answer.

Question 16

Of critical importance for published research papers in reputable scientific journals is that each paper has been thoroughly __________ by several world experts in the field.

A. heavily criticised
B. paid for
C. peer reviewed
D. praised
E. reworded

This question relates to video 4.2 and the detailed notes in section 4.2.2.

Choice A is not correct. It is not a requirement that a manuscript be heavily criticised by the referees, but if this was so then the manuscript would almost certainly be rejected.

Choice B is not correct. The referees certainly do NOT pay for the manuscript to be published.

Choice C is the **correct** option. To quote the notes: "All the peer reviewers, i.e., referees, are world experts in the field of your research, and they will be looking for errors, mistakes, things you might have overlooked and suitability of the work for the journal."

Choice D is not correct. It is not a requirement that a manuscript be praised by the referees.

Choice E is not correct. It is not a requirement that a manuscript be thoroughly reworded by the referees, although they may occasionally make some suggestions here and there.

Question 17 (revised for consistency with the current content on accuracy and uncertainty)

An instrument was used to measure the level of toxic chemicals in water. The instrument was accurate, but had high uncertainty in its individual readings.

(i) Does this instrument possess a large systematic error?

(ii) Can a single reading from this instrument be expected to always give a result very close to the true value?

A. Incorrect question. Because the instrument possesses a high uncertainty, it can not possibly be accurate in the common definition of accuracy.
B. (i) No
(ii) No
C. (i) No
(ii) Yes
D. (i) Yes
(ii) No
E. (i) Yes
(ii) Yes

This question relates to videos 4.3 and 4.4 and the detailed notes. An instrument that is accurate means that the average of many readings from it will give an average value close to the true value it is trying to measure. In the common definition of accuracy, an instrument must possess a low, or tiny, systematic error. It may have high, or large, random error, i.e., large uncertainty, but this does not enter into the meaning of accuracy in the common definition. Because of the large uncertainty associated with the individual readings, there is no way we can expect any individual reading to give us a result very close to the true value because we are told the instrument has a high uncertainty. Indeed, if it always gave a result very close to the true value then this would necessarily mean the instrument has a *low* uncertainty.

Question 18

Choose those options that, when combined, best describe a randomised controlled double-blind trial.

A. Double-blinds are used to physically separate experimental and control groups.
B. The subjects do not know if they are in the experimental or control group.
C. The subjects are randomly picked.
D. The subjects are randomly picked to go into either the control or experimental group.
E. Those working with the subjects do not know if the subjects are in the experimental or control group.

The question refers to video 4.5 and the detailed notes. A randomised controlled double-blind trial is a trial in which, firstly, it is completely random as to whether a subject is assigned to the experimental or control group. This is the meaning of the “randomised controlled” part. And secondly, the meaning of the “double-blind” part is that (a) the subjects do not know if they are in the control or experimental group, and (b) those working with the subjects also do not know if the subjects they are working with are in the control or experimental group.

Choice A is not correct, as it has nothing to do with the meaning of “double-blind”.

Choice B is a **correct** option. It is the first half of the meaning of “double-blind”.

Choice C is not correct as it is not the meaning of “randomised” here.

Choice D is a **correct** option as it is the meaning of “randomised controlled” here.

Choice E is a **correct** option. It is the second half of the meaning of “double-blind”.

Question 19

In the research article, "Maternal Intuition of Fetal Gender", McFadzen et al., *J. Patient Cent. Res. Rev.*, **4** (2017) 125 – 130, 53 pregnant women claimed they had strong intuition regarding the gender of their baby. Of these 53 women, 33 predicted their baby's gender correctly. The margin of error for this experiment is ±13% at the 95% confidence level. Can we conclude with 95% confidence that these women indeed possess intuition about the gender of their baby and why? Choose the correct answer (choose either yes or no) and reason (choose a percentage ±13% option).

A. 33% ±13% does not include 50%
B. 50% ±13% includes 50%
C. 62% ±13% includes 50%
D. No
E. Yes

This question is related to the material given in video 4.5 and the detailed notes.

We are given the margin of error here at the 95% confidence level, and we are also told that out of 53 pregnant women with a strong intuition of their baby's gender, 33 predicted it correctly, i.e., 33/53 = 62% correctly predicted their baby's gender. Placing the margin of error down on this percentage we obtain 62% ± 13% correctly predicted their baby's gender at the 95% confidence level. **Only choice *C*** corresponds to these numbers.

For all practical purposes there is no bias to which gender is present in pregnant women. That is, we are just as likely to find a male as a female in any randomly chosen pregnant woman. This means there's a 50% chance that the baby is a boy and 50% chance it's a girl. In order to rule out "lucky guess" as a possible explanation for women being able to predict the gender of their baby, we need to ensure that the result of our experiment doesn't include 50% because 50% is the result we expect to get if we had a very large number of women simply anyhow naming the gender of their baby. To rule out "lucky guess" we need to ensure that 50% isn't found in the 95% confidence interval.

Here, this group of allegedly strongly intuitive women were right 62% ± 13%. 62% - 13% is 49%, so definitely 50% lies within the confidence interval. For us to be 95% confident that we did have a strongly intuitive group of women, we would have required at least 64% of them being correct in their predictions. This is because 64% ± 13% does not include 50%. However, we have only 62% ± 13% which **does** include 50%, so we can not be 95% confident that this group is strongly intuitive. **This is choice *D***.

Interestingly, we are referring to the group of 53 women here collectively as if they were a single entity, like a single person being able to predict the outcome of a coin toss. What we don't know is that some of the women in this group of 53 might really be intuitive when they say they are, but we also know (with 95% confidence) that many aren't intuitive when they say they are.

Lastly, we are still "only" 95% confident that this *group* is not strongly intuitive. There is a 1 in 20 chance that we got it wrong, and the group really is strongly intuitive.

Thus is the nature of statistics.

Question 20

A randomised controlled double-blind trial was used to determine if people felt much happier after drinking water containing a “special” tasteless additive. The control group were given regular water to drink. The experimental group were given water with the “special” tasteless additive. There was 50 people in each group. 20 in the control group said they felt much happier, whereas 26 in the experimental group said they felt much happier. Does this experiment demonstrate, at the 95% confidence level, that the “special” tasteless additive makes people feel happier? Choose the correct answer (choose either of the options starting with “Yes…” or “No…”) and the rule of thumb you applied.

- **A. No, the difference is probably not statistically significant at the 95% confidence level.**
- **B. The overlap of the CIs is greater than one-third of the range covered by the two CIs.**
- C. The overlap of the CIs is less than one-third of the range covered by the two CIs.
- D. There is no overlap between the CIs of the two groups.
- E. Yes, the difference is statistically significant at the 95% confidence level.

This question refers to material in video 4.5 and the detailed notes.

We will call feeling happier after drinking a “success”. We have 20/50 = 40% successes in the control group, and 26/50 = 52% successes in the experimental group. Next, we need to determine the margin of error at the 95% confidence level. Referring to Table 5.1 of the text book we find that for sample size of 50, our margin of error is ± 14%. The CI for the control group is therefore 26% - 54%, and for the experimental group it’s 38% - 66%. Immediately we can see there’s quite a bit of overlap of these two CIs, so immediately we know that the difference isn’t statistically significant that the 95% confidence level, which is our first rule of thumb. This eliminates choices *D* and *E*.

To see if it’s likely to be statistically significant we need to figure out just how much overlap there is. The full range of our combined CIs is 26% - 66%, or a total of 40 percentage points. The overlap portion is 38% - 54%, for a total of 16 percentage points. This represents an overlap of 16/40 = 40% of the full range of the CIs, and is clearly more than one-third of the full range thus eliminating choice *C*. Applying the third rule of thumb (**choice *B***) we note that the difference is probably not statistically significant at the 95% confidence level (**choice *A***).