Financial Lit Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

WS Assessment

Target 27:

Argument, logical fallacies and crytography

**I can:**

* Understand the structure of logical arguments by identifying the premise(s) and conclusion.
* Distinguish between inductive and deductive arguments
* Make a set diagram to evaluate deductive arguments
* Determine if a deductive argument is valid and/or sound
* Identify common logical fallacies and their use in arguments

**Unit 12 Math Topics:**

* Boolean Algebra
* Venn Diagram

**Logical Arguments**

A logical argument is a claim that a set of **premises** support a **conclusion**. It is possible for a logical argument to have one or many premises, but **there must be one** conclusion. We will look at types of arguments and how to determine the strength, validity and/or soundness of each type.

Consider the following argument:

*When I went to the store last week, I forgot my wallet, and I forgot it again when went back today. I always forget my wallet when I go to the store.*

Rewrite it in “premise, premise, conclusion” form.

Premise: I forgot my wallet when I went to the store last week.

Premise: I forgot my wallet when I went to the store today.

Conclusion: I always forget my wallet when I go to the store.

Rewrite the argument in “premise, premise, conclusion” form.

*Jill must be a firefighter since all firefighters know CPR and Jill knows CPR.*

Premise:

Premise:

Conclusion:



Rewrite the following arguments in a precise “premise, premise, conclusion” form, and determine if the argument is inductive or deductive.

*A number is prime if it is only divisible by itself and one. Since the number 13 is only divisible by itself and one, 13 must be prime.*

Premise:

Premise:

Conclusion:

The argument is deductive / inductive

*Juan’s dog Goober is having puppies. All three of Goober’s previous litters have had 5 puppies so Goober is bound to have 5 puppies in this litter as well*.

Premise:

Premise:

Conclusion:

The argument is deductive / inductive

**Evaluating Arguments**

*Inductive arguments* cannot be proven. The best we can do is evaluate the strength of the argument based on the evidence it provides.

Many scientific theories, such as the big bang theory, can never be proven. Instead, they are inductive arguments supported by a wide variety of evidence. Usually in science, an idea is considered a hypothesis until it has been well tested, at which point it graduates to being considered a theory. Common scientific theories, like Newton’s theory of gravity, have all stood up to years of testing and evidence, though sometimes they need to be adjusted based on new evidence, such as when Einstein proposed the theory of general relativity.

*Deductive arguments*, on the other hand, can be proven and their validity and soundness can be evaluated. The validity of the argument is based on whether the conclusion follows logically from the premises, while the soundness of the argument is based on whether or not the premises seem true. An argument cannot be sound if it is not valid, even if the premises seem reasonable.

Re write the following argument in its “premise, premise, conclusion” form then determine whether the argument is **valid**. If the argument is valid, determine if it is also **sound**.

|  |  |
| --- | --- |
| *“All cats are mammals and a tiger is a cat, so a tiger is a mammal.”*  Premise:  Premise:  Conclusion:  Valid  Sound | *“All water bottles are plastic. This is a water bottle, so it must be plastic.”*  Premise:  Premise:  Conclusion:  Valid  Sound |
| “All firefighters know CPR. Jill knows CPR, so Jill must be a firefighter.”  Premise:  Premise:  Conclusion:  Valid  Sound | “None of my friends like dancing. Kai doesn’t like dancing. Therefore, Kai is my friend.”  Premise:  Premise:  Conclusion:  Valid  Sound |

**Logical Fallacies**

We have seen that logical arguments are invalid when the premises are not sufficient to guarantee the conclusion, and that even if an argument is valid it may be unsound if the premises are not true. There are other ways that a logical argument may be invalid or unsound. One of the more common ways this can occur is if the argument is a fallacy.

A **fallacy** is a type of argument that appears valid but uses a logical error to persuade or deceive. Fallacious arguments are especially common in advertising and politics, so it is important as informed citizens to recognize when we are being presented with a fallacious argument and to not be persuaded by it.

**Cryptography**

When people need to secretly store or communicate messages, they turn to cryptography. Cryptography involves using techniques to obscure a message so outsiders cannot read the message. It is typically split into two steps: encryption, in which the message is obscured, and decryption, in which the original message is recovered from the obscured form.



Use the Caesar cipher with shift of 3 to encrypt the message: “We ride at noon”

Decrypt the message GZD KNK YDX MFW JXA if it was encrypted using shift cipher with shift of 5.

Suppose you intercept a message, and you know the sender is using a Caesar cipher, but do not know the shift being used. The message begins EQZP. How hard would it be to decrypt this message?

Another approach to cryptography is **transposition cipher** done by writing the message in rows, then forming the encrypted message from the text in the columns.

Encrypt the message “Meet at First and Pine at midnight” using rows 8 characters long.

We write the message in rows of 8 characters each. Nonsense characters are added to the end to complete the last row.

MEETATFI

RSTANDPI

NEATMIDN

IGHTPXNR

We could then encode the message by recording down the columns. The first column, reading down, would be MRNI.

Altogether, the encoded message would be MRNI ESEG ETAH TATT ANMP TDIX FPDN IINR.

Encrypt the message “Buy some milks and eggs” using a transposition cipher using rows 5 characters

More complex versions of this rows-and-column based transposition cipher can be created by specifying an order in which the columns should be recorded.

To make the encryption key easier to remember, a word could be used. For example, if the key word was “MONEY”, it would specify that rows should have 5 characters each. The order of the letters in the alphabet would dictate which order to read the columns in.

MONEY 🡪 EMNOY = 41325

Encrypt the message BUY SOME MILK AND EGGS using a transposition cipher with key word MONEY. Writing out the message in rows of 5 characters:

BUYSO Rearrange SBYUO

MEMIL 41325 IMMEL

KANDE DKNAE

GGSPK PGSGK

We now record the columns: SIDP BMKG YMNS UEAG OLEK

Decrypt the message CEE IAI MNL NOG LTR VMH NW using with rows of 5 characters.

Since there are total of 20 characters and each row should have 5 characters, then there will 4 rows

We start writing, putting the first 4 letters, CEEI, down the first column.

CALLM

EINTH

EMORN

INGVW

We can now read the message: CALL ME IN THE MORNING VW. The VW is likely nonsense characters used to fill out the message.

Decrypt the message RHA VTN USR EDE AIE RIK ATS OQR using a row-and-column transposition cipher with keyword PRIZED.

**Public Key Cryptography**

Suppose that you are connecting to your bank’s website. It is possible that someone could intercept any communication between you and your bank, so you’ll want to encrypt the communication. The problem is that all the encryption methods we’ve discussed require than both parties have already agreed on a shared secret encryption key. How can you and your bank agree on a key if you haven’t already? This becomes the goal of **public key cryptography** – to provide a way for two parties to agree on a key without a snooping third party being able to determine the key. The method relies on a one-way function; something that is easy to do one way, but hard to reverse. Google more if want to learn.

**Assessment Target 27**

**I can…** determine if a deductive argument is valid and/or sound ; identify common logical fallacies and their use in arguments .

Rewrite each of the following arguments in their “premise, premise, conclusion” form, and determine whether the argument is **inductive** or **deductive**.

If the argument is inductive, determine its strength.

If the argument is deductive, determine the validity of the argument, and state whether the argument is sound.

Since all cats are scared of vacuum cleaners and Max is a cat, Max must be scared of vacuum cleaners.

Every day for the last year, a plane flew over my house at 2 pm. Therefore, a plane will always fly over my house at 2pm.

Kiran collected data on the salaries of their friends. They found that female and nonbinary friends made less than male friends, so they concluded that women and nonbinary people make less than men.

Some of these kids are rude. Jimmy is one of these kids. Therefore, Jimmy is rude!

All bicycles have two wheels. My friend’s Harley-Davidson has two wheels, so it must be a bicycle.

Encrypt the message THE FINAL IS HERE using a transposition cipher with key word EXAM

Show work.