

Midterm - INTD290

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1 How to Submit this Midterm

1. Complete your work on this midterm.
2. Scan it into PDF form using a smartphone app, scanner, or digital picture
3. Alternatively you can type up your answers in a separate file, but it still must be a PDF
4. Submit it using the link on Moodle

2 Maps of The New World

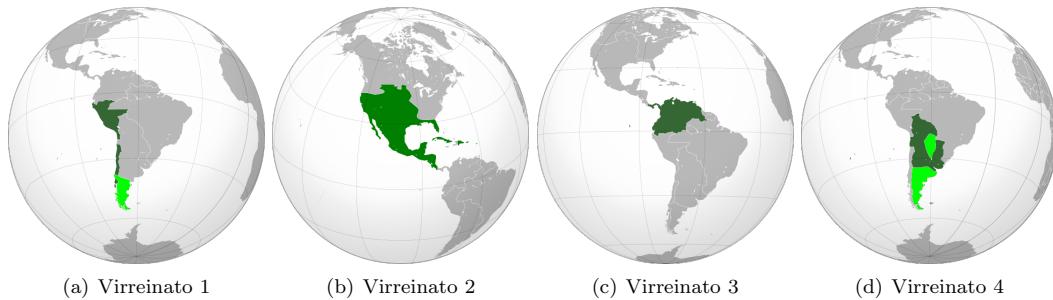


Figure 1: There were up to four *virreinatos* during the Spanish colonial period of Latin American history.

1. In which of the four *virreinatos* of the Spanish colonial empire (shown in Fig. 1) was the *tle huitzilin* classified by the indigenous? [Virreinato 2, Nueva España](#)
2. Which of the four *virreinatos* excelled at the exportation of rum? [Virreinato 3](#)
3. Which of the four *virreinatos* was characterized by an indigenous empire that mastered agriculture in the Andean mountains? [Virreinato 1, Peru](#)
4. The low-latitude aurora of 1789 was observed in *which cities?* In which of the four virreinatos are these cities? List some other countries in which corresponding observations were made. [Mexico City, Virreinato 2, Sweden, Poland, Cuba](#)
5. List some of the locations explored by La Condamine and his Latin American colleagues, and cite the virreinato or virreinatos they explored together. [Virreinato 1, Viceroyalty of Peru, and City of Quito](#)
6. The Expedición Botánica of José Celestino Mutis took place in which virreinato? [Virreinato 2](#)
7. José Celestino Mutis took place in which virreinato? Mutis was the inaugural chair of the department of mathematics at the *Colegio del Rosario*. In which city is this? [Virreinato 2, Santa Fe](#)
8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been in the 18th century? [Virreinato 4](#)



Figure 2: (Left) A physics detector near Pico de Orizaba in Mexico. (Right) A town in central Mexico.

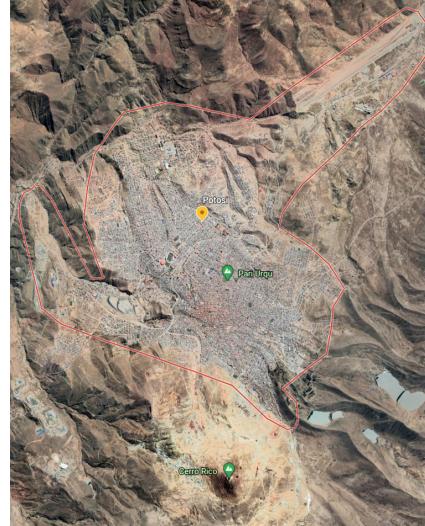


Figure 3: A historical location in Latin America known for driving a particular economic sector.

3 Asynchronous Activity Review I

- What is the physics detector shown in Fig. 2 (left)? Explain in basic terms the purpose of this detector and how it works.

That is the HAWC Gamma Ray Observatory, located outside of Mexico City by Pico de Orizaba. It is used to detect gamma rays by using specifically designed technology that can detect gamma rays by the optical flashes that are created due to the gamma rays.

- What is the significance of Mexican cities as pictured in Fig. 2 (right), in the context of the development of colleges and the scientific community in 18th century Mexico?

The city pictured is Potosí, which was not a thriving city in the 18th century but due to the explorations and push for scientific knowledge, this lost city was found. Many cities like this allowed and pushed for new discoveries to be made, and thus pushed the scientific revolution further. Cities like this also allowed for the continuation and building of new colleges and universities, and to be able to study on the grounds of scientific discovery. This is seen many times in the history of science in Latin America, as explorers find new places they build colleges and universities to teach themselves and the natives.

- What city is being shown in Fig. 3? In which country is it located, and what was the historical significance of this city for international trade? Who controlled it? From where the commodity produced here originate, and how was it shipped to Europe and Africa?

Potosí which is located in Bolivia. It is best known for its elevation/mountain which led to massive amounts of mining by those who conquered the area. These massive mining projects forced them into the spotlight of international trade with the mass production of silver. The Spanish were the first to conquer and then colonize the area, thus profiting from the destruction of the land. Many explorers tried to find a better way in and out of the area, tried using Paraguay and Chaco Rivers, but eventually by mass mining and destruction of land new water ways and travel ports were human-made.

Mid Term

$$\begin{array}{r} 1 \\ 20 \\ 400 \end{array}$$

$$\begin{array}{r} 1536 \\ 336 \\ 16 \end{array}$$

4. a. $80 + 20 = \underline{\quad} + \underline{\quad} = \underline{\quad}$

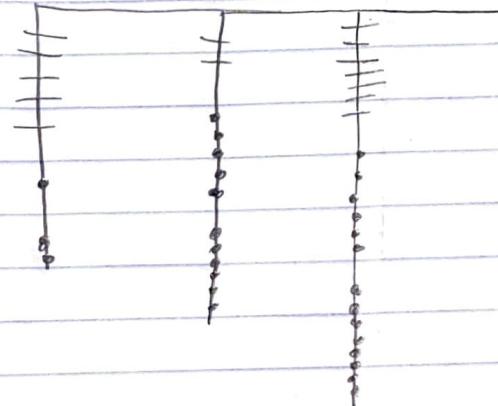
b. $365 + 565 = \underline{\quad} + \underline{\quad} = \underline{\quad}$

c. $1024 + 512 = \underline{\quad} + \underline{\quad} = \underline{\quad}$

2. a. $1024 - 512 = \underline{\quad} - \underline{\quad} = \underline{\quad}$

b. $92 - 31 = \underline{\quad} - \underline{\quad} = \underline{\quad}$

3. a. $512 + 256$



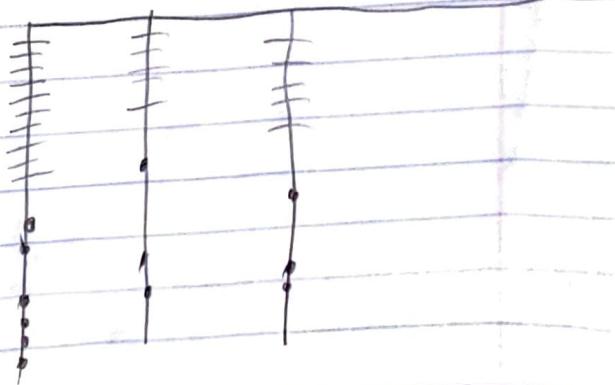
b. $11 + 89$



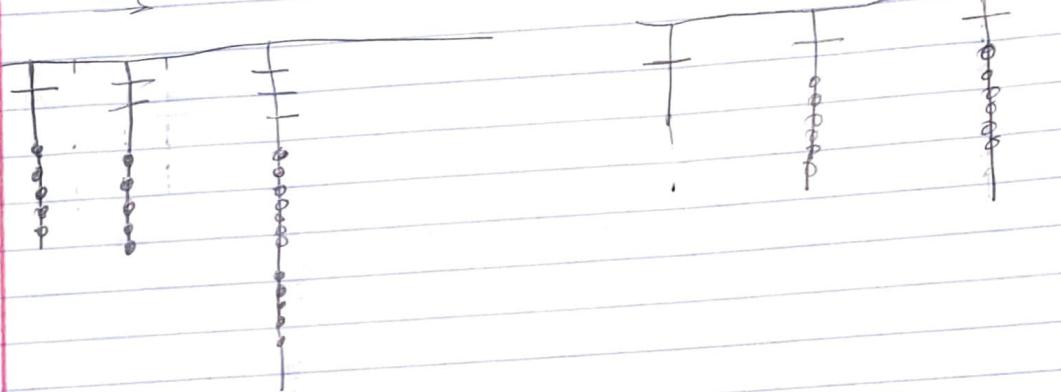
4. a. $365 - 67$



b. $1024 - 512$



4.
 5. 2 for potatoes 4 for quinoa
 $.2 + .2 = .4$
 $30 \times 5m = 150$
 a. 37,500 potatoes b. 1,600 quinoa
 $\downarrow 25 \qquad \downarrow 16$



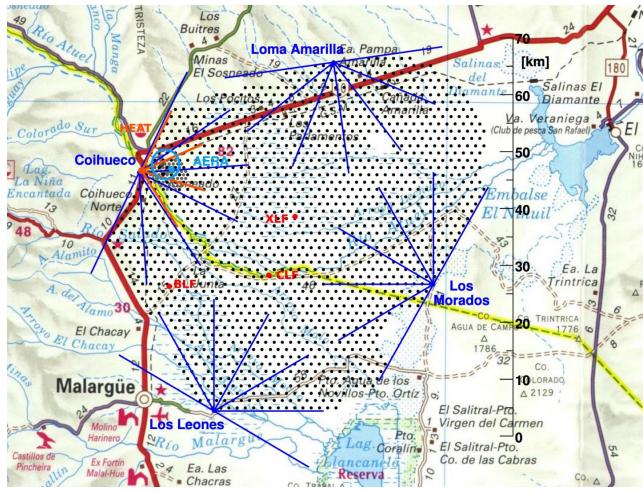


Figure 5: A physics detector near Malargüe, Argentina.

4. Work out the following subtraction problems *using the Incan quipu*:

(a) $365 - 67 =$

(b) $1024 - 512 =$

5. Suppose you have three terrace plots in the Andean mountains to use to survive. You and your cohort of fellow Incans decide to grow potatoes and quinoa. Quinoa actually do better at higher altitudes than potatoes. So the plan is to use the two lowest terraces for potatoes, and the upper four for quinoa. Each terrace is 30 meters by 5 meters. A potato plant requires a 0.2 meter by 0.2 meter patch, and a quinoa plant requires a 0.3 meter by 0.3 meter patch. How many potato plants and how many quinoa plants can you plant? Store the results in a diagram of quipu knot system. 6

5 Connection to Physics

- In Fig. 5, what physics detector is shown?
 - A: The Large Hadron Collider
 - B: The IceCube Neutrino detector
 - C: The Pierre Auger Observatory
 - D: The High Altitude Water Cherenkov detector
- What is the purpose of the physics project shown in Fig. 5?
 - A: To collide protons and nuclei to probe sub-atomic physics
 - B: To detect signals from neutrinos that originate outside the solar system
 - C: To detect cosmic rays that originate outside the solar system
 - D: To detect gamma rays from space

3. What is a gamma ray?
- A: A photon of light
 - B: A proton or nucleus from deep space
 - C: A portion of the aurora borealis
 - D: An ion floating in the atmosphere
4. What is located at each black dot in Fig. 5?
- A: A water tank designed to record Cherenkov radiation
 - B: A radio receiver designed to record radio pulses
 - C: An optical sensor designed to record visible light
 - D: A telescope designed to detect infrared radiation

6 Vocabulary

1. What is the meaning of the term *rationalism*?
- A: The idea that reason rather than experience is the foundation of certainty in knowledge
 - B: Encapsulating the idea of *I think, therefore I am*.
 - C: Using scientific instruments
 - D: Relying on measurements and sensory experience to discover the truth
2. What is the meaning of the *Nahuatl* term *abuizotl*?
- A: A horse
 - B: A hummingbird
 - C: An otter
 - D: An alligator
3. What is the meaning of the *Nahuatl* term *tomatl*?
- A: Smoked fish
 - B: Smoked chili
 - C: An herb to help digestion
 - D: A tomato
4. What is *cinchona*?
- A: An herb used to treat indigestion
 - B: A shrub or tree used to create quinine
 - C: A flower used in religious rituals of the *Mexica* people
 - D: A plant that can form a treatment for syphilis
5. Define the word *torpor*, as it pertains to animal behavior.
- A: The ability to hover in midair during flight using rapid wingbeats
 - B: Lowering internal body temperature and metabolism to levels that render the individual immobile and in a hibernating state
 - C: The ability to break open the shells of mollusks using tools
 - D: The ability to distinguish complex sounds in songs or calls
6. Who were the *Jesuits*?
- A: Formally known as the Order of Preachers, this is a Catholic order founded by Saint Dominic
 - B: Formally known as the Order of Friars Minor, this is a Catholic order founded by Saint Francis
 - C: Formally known as *Los Amigos del País*, these were mining officials who formed guilds to further economic interests of their region
 - D: Formally known as the Society of Jesus, this is a Catholic order founded by Saint Ignatius of Loyola

7 Free Response Section

1. **Kepler's Laws, and Newtonian Physics** Discuss the varying levels of acceptance within scientific and academic communities in Nueva Granada and Perú in the late 18th century.

In the beginning Newtonian ideas were not accepted, but as more people became educated and rationalism became more popular, Newtonian physics and theories grew and expanded. They still were not accepted anywhere the church still had power or where the church then took power back, like in the case of the Dominicans and Jesuits. They began teaching Newtonian physics and the church then took their land and universities back from them to teach what they believed was correct. Overtime Newtonian became more popular and more scientists became famous for their teachings, for example Jose Celestino Mutis. It took many years of fighting for Newtonian and Copernican theories to become more widely accepted and taught, and once the church lost a lot of their political power universities were then able to teach what they wanted to.

2. **The aurora of 1789** Discuss the significance of the aurora borealis in 1789 that was visible from Mexico City. List several researchers who made observations of this aurora and other auroras, and explain what they found.

For as long as people had known about aurora borealis it was always assumed that they only happened up north or places farther away from the equator. The one in Mexico City in 1789 changed the entire perspective on aurora borealis. Jose Antonio Alzate, Antonio de Leon y Gama, and Jose Francisco Dimas Rangel were the three Mexican researchers who observed the aurora. Observing the aurora shoved these into the scientific spotlight and allowed for more scientific discoveries to be made. One of those was the experimenting done to try and recreate an aurora so that they could understand what actually was happening, and even with new models and theories, auroras are still a mystery.

3. **Herbal medicine in the 16th century** Give several examples of treatments for various ailments in the body used by Europeans and indigenous Latin Americans in the 16th century. Explain the theory of the four humors and why this influenced the European treatments but not the indigenous ones.

Most treatments in the 16th century were purely natural resources, for examples the cinchona plant was made into a type of malaria prevention and treatment called quinine. Indigenous Latin Americans were known to use beliefs in witch craft to heal and treat ailments. Europeans frowned upon this and more focused on "scientific" treatments, like bloodletting with leeches. As they believed there were only four humors in a body, blood, phlegm, black, and yellow bile, there were only treatments surrounding these four parts of the body. Europeans believed in this as it was what they knew, indigenous groups had their own beliefs and treatments before Europeans colonized the area, thus it did not change how they saw the human body.

4. **The Inquisition, the Catholic Church, and Scientific Traditions** Discuss several examples of the following:
(a) Catholic censorship of knowledge flowing from Europe to Latin America
(b) Catholic censorship of knowledge flowing from Latin America to Europe
(c) contributions to Latin American science by Catholic scholars and explorers
(d) knowledge that was recorded or translated from indigenous sources by Catholic priests, monks, or nuns.

It has long been known that the Catholic Church has been, somewhat, corrupt. One example of this is the censorship of knowledge and education between Latin America and Europe. As they colonized the area they made sure to limit the knowledge of the natives to ensure they could secure power and later political power. This is seen between the scientific discoveries of the indigenous people of Latin America and Europe, colonizers did not believe in what the natives had found so they made sure not to share many of their ideas with Europe. They then also controlled the knowledge of people in Latin America by deciding curriculum, libraries, where universities are, and which universities degrees actually mean anything. The church continued to strive for more political power by controlling this knowledge and stopped the transport of books and other scientific knowledge from Europe. One Catholic explorer that contributed to Latin American science was Charles de la Condamine, who became famous for exploring the Viceroyalty of Peru, and thanks to this expedition further pushed science into the culture of the area. Lastly, most things that we know about the beliefs of indigenous people are from the writings of the Catholic colonizers. Because most knowledge from early indigenous people were passed on orally, most of what they did and believed were not written down until the Catholics wrote it down for them, with their own biases. Later as universities and monasteries opened priests and nuns were able to learn from the indigenous people and actually write down what they found, which then lead to the massive private library collections that were seen in this time period.