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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

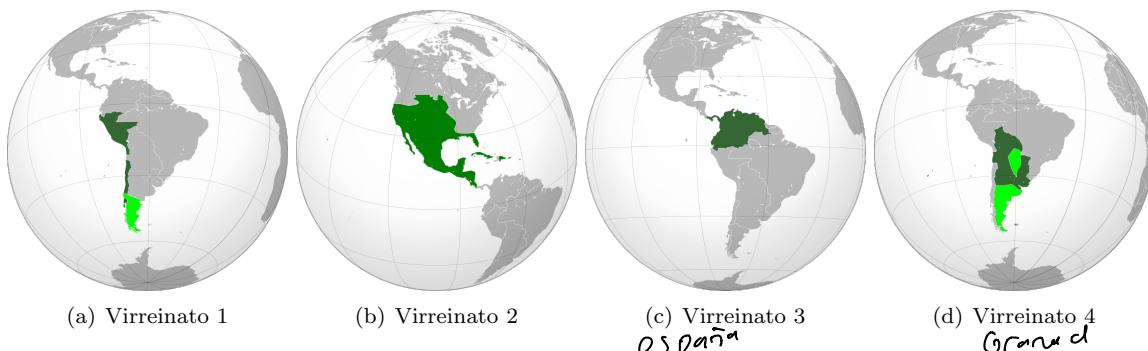


Figure 1: There were up to four *virreinatos* during the Spanish colonial period of Latin American history.

1. In which of the four *virreinatos* of the Spanish colonial empire (shown in Fig. 1) was the *tlé huitzilin* classified by the indigenous? **B** ✓
2. Which of the four *virreinatos* excelled at the exportation of rum? **D** ✓
3. Which of the four *virreinatos* was characterized by an indigenous empire that mastered agriculture in the Andean mountains? **A** ✓
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* ✓, **B**, *Spain* ✓
5. List some of the locations explored by La Condamine and his Latin American colleagues, and cite the virreinato or virreinatos they explored together. *Peru, Quito, A + C* ✓
6. The Expedición Botánica of José Celestino Mutis took place in which virreinato? **C** ✓
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? *Bogota* ✓
8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been in the 18th century? *Argentina*, **A** -1 *Río de la Plata*



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

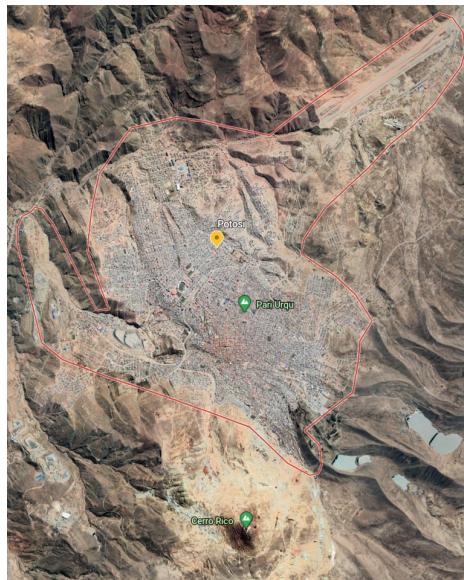


Figure 3: A historical location in Latin America known for driving a particular economic sector.

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.

HAWC Gamma Ray Observatory. To detect and triangulate the origin of high energy gamma rays from space.
-1/2 great, but how does it work?

- 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?

They were located near mountains where silver was prevalent. Mining techniques were developed using science, which required infrastructure of research and education. This led to the creation of colleges and scientific communities which grew thanks to the explosion of scientific development. These colleges are here to this day. ✓

- 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 originated, and how was it shipped to Europe and Africa?

Potosí, Bolivia, controlled by the Spanish. Mined silver. Using llamas or mules, they were brought to the pacific to be shipped back. Well, I don't know if they went the pacific route, where are the ports?

4 Asynchronous Activity Review II

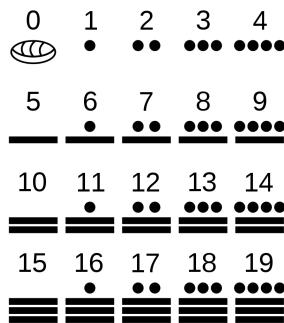


Figure 4: A list of the numerical digits used by the Maya.

1. Work out the following addition problems *using the Mayan system*.

(a) $80 + 20 =$

$$\begin{array}{r} \text{---} \\ \text{...} \\ + \end{array} \quad \begin{array}{r} \text{---} \\ \cdot \\ + \end{array} = \quad \begin{array}{r} \text{---} \\ \text{---} \\ \checkmark \end{array}$$

$$20 \sqrt{360} \\ \underline{20} \\ 160$$

(b) $365 + 365 =$

$$\begin{array}{r} \text{---} \\ \text{...} \\ + \end{array} \quad \begin{array}{r} \text{---} \\ \text{...} \\ + \end{array} = \quad \begin{array}{r} \text{---} \\ \cdot \\ \checkmark \end{array}$$

(c) $1024 + 512 =$

$$\begin{array}{r} \text{---} \\ \text{...} \\ + \end{array} \quad \begin{array}{r} \text{---} \\ \text{..} \\ + \end{array} = \quad \begin{array}{r} \text{---} \\ \text{---} \\ \checkmark \end{array}$$

2. Work out the following subtraction problems *using the Mayan system*.

(a) $1024 - 512 =$

$$\begin{array}{r} \text{---} \\ \text{...} \\ - \end{array} \quad \begin{array}{r} \text{---} \\ \text{..} \\ - \end{array} = \quad \begin{array}{r} \text{---} \\ \text{---} \\ \checkmark \end{array}$$

(b) $92 - 31 =$

$$\begin{array}{r} \text{---} \\ \text{..} \\ - \end{array} \quad \begin{array}{r} \text{---} \\ \text{---} \\ - \end{array} = \quad \begin{array}{r} \text{---} \\ \text{..} \\ \rightarrow \textcircled{1} 41, \\ \text{missing 1 dot} \end{array}$$

3. Work out the following addition problems *using the Incan quipu*:

(a) $512 + 256 =$

$$\begin{array}{r} \text{---} \\ \text{..} \\ - \end{array} \quad \begin{array}{r} \text{---} \\ \text{...} \\ - \end{array} \quad \begin{array}{r} \text{---} \\ \text{---} \\ - \end{array} \quad \begin{array}{r} 8 \\ 6 \\ 5 \\ \textcircled{1} \\ 568? \end{array}$$

(b) $11 + 89 =$

$$\begin{array}{r} \text{---} \\ \text{..} \\ - \end{array} \quad \begin{array}{r} \text{---} \\ \text{...} \\ - \end{array} \quad \begin{array}{r} \text{---} \\ \text{---} \\ - \end{array} \quad \begin{array}{r} \checkmark \\ \text{---} \end{array}$$

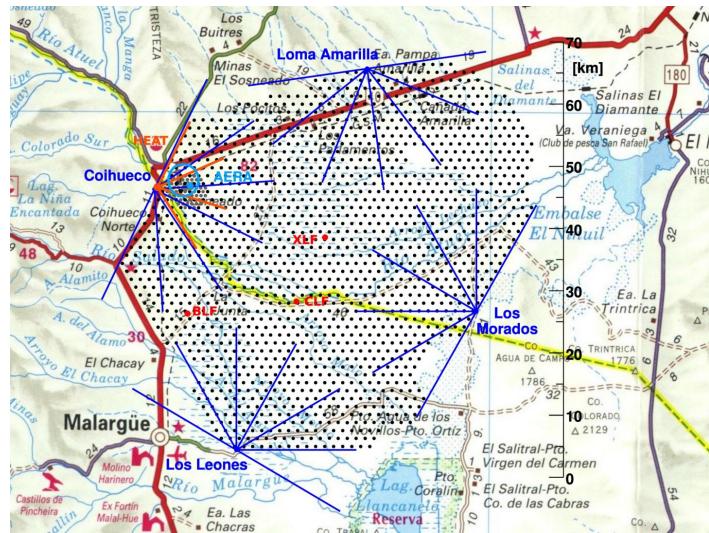
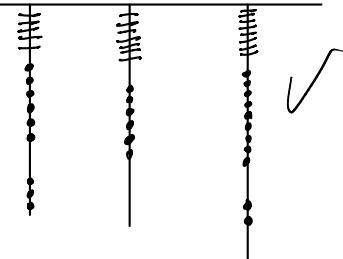


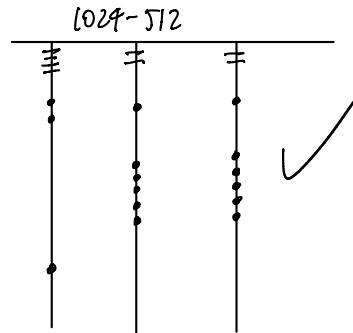
Figure 5: A physics detector near Malargüe, Argentina.

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

(a) $365 - 67 =$



(b) $1024 - 512 =$

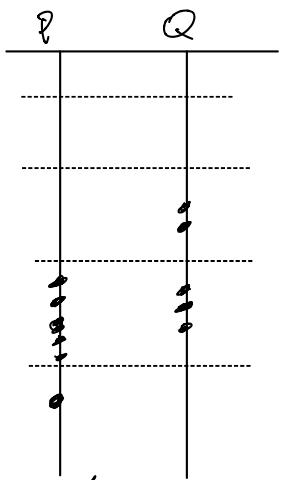


5. Suppose you have three terrace plots in the Andean mountains to use to survive. You and your cohort of fellow Incans decide to grow potatoes and quinoa. Quinoa actually do better at higher altitudes than potatoes. So the plan is to use the two lowest terraces for potatoes, and the upper four for quinoa. 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.

$$\begin{aligned} & 30 \times 5 \\ & \text{potatoes: } 0.2 \text{ m} \cdot 0.2 \text{ m} \\ & \quad \times 4 \\ & \text{Quinoa: } 0.3 \text{ m} \cdot 0.3 \text{ m} \\ & \quad \times 2 \end{aligned}$$



$$\begin{aligned} & 5 \div 0.2 = 25 \\ & 30 \div 0.2 = 150 \\ & 25 \cdot 150 = 3750 \\ & \quad \times 4 = 15000 \\ & 5 \div 0.3 \approx 16.7 = 16 \\ & 30 \div 0.3 = 100 \\ & 16 \cdot 100 = 1600 \\ & \quad \times 2 = 3200 \end{aligned}$$



(I get 7500 potatoes,
for 2 plots)
(6667 quinoa)

5 Connection to Physics

1. 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



2. 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 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.

There was great interest in new ideas by the scientific communities in Nueva Granada and Perú which we can observe by the consumption and collection of enlightenment books. With libraries such as Francisco José de Caldas's in Granada and the rampant smuggling of forbidden scientific texts in Perú, authorities such as the Viceroy had had an uphill battle in a war for censorship.

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.

It was significant because it was observed at latitudes far lower than claimed by European scientists. The three scientists who researched the phenomenon were Antonio de León y Gómez, José Antonio Alzaga y Ramírez, and José Francisco Díaz. They found sun spots which are dark areas on the surface of the sun and correlated with low latitude auroras.

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.

Dysentery (Europe): Scare the patient (???) OR drink a mix of horse manure and wine. Diarrhea (Latin America): Drink water boiled with tzipipatli. Broken Ribs (Europe): Plaster dried goat manure with wine onto the ribs. Latin America; reset the bone, then create a splint using zacacili roots.

The four humors is the theory that every person's health is a balance between: blood, yellow bile, phlegm, and black bile, and a disease or ailments were a result in an disturbance to each person's levels. These ideas were found in Greek traditions and apparently it was the best they had because they continued using it for over a thousand years. The linear way of thinking in the four humors, believing that everything is either hot or cold and wet or dry were all very theoretical with any objections reasoned away. Rather in Latin America treatments were developed based on trial and error and experiences of what worked.

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.

A: The Church was in constant struggle against the free flow of knowledge. Works by Voltaire and Rousseau were banned and the importation of banned books had to be smuggled into countries. The new Copernican ideas were also challenged by the Church. Though it was impossible to control the thoughts of scientists the Church tried, banning his works in favor of the traditional Tycho model of the solar system.

→ Tycho Brahe proposed geocentric model, but after things orbit Sun

B: In the early years of the colonies the Church tried to control the practice and development of medicine, though this ended as it failed to realize alternative sources of treatment from the natives. The Church also kept a book by Martin de la Cruz and Juan Badiano called Little Book of Medicinal Herbs of the Indians locked in the Vatican Archives for over four centuries.

C: The Patio method, a revolutionary mining method was discovered by a theologian Bartolommeo de Medina. There was also Jose Mutis, a priest who's expedition on botany in Spanish America paved the way for the field.

D: There was the works of Father Bernardino de Sahagún on the indigenous knowledge on flora and fauna, as well as Father Juan Magnin's data species such as rubbing trees and other species used as narcotics by the natives.

