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Midterm - INTD290

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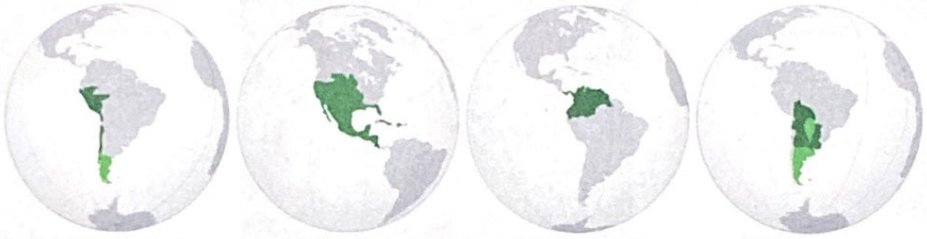
485/50

Nice job!

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



(a) Virreinato 1 (b) Virreinato 2 (c) Virreinato 3 (d) Virreinato 4

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? B ✓
2. Which of the four *virreinatos* excelled at the exportation of rum? C ✓
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.
   In Mexico City & Zacatecas which are in Virreinato B (Nueva España).
   The Aurora was also observed in Cuba, Rosia, & Inglaterra. ✓
   Prussia, England
5. List some of the locations explored by La Condamine and his Latin American collegues, and cite the virreinato or virreinatos they explored together.
   They explored the virreinato de Peru. ✓ (-1/2) also Ecuador Quito, and Colombia
6. The Expedición Botánica of José Celestino Mutis took place in which virreinato? Nueva Granada 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? Santa Fe ✓
8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been in the 18th century? Argentina, D ✓

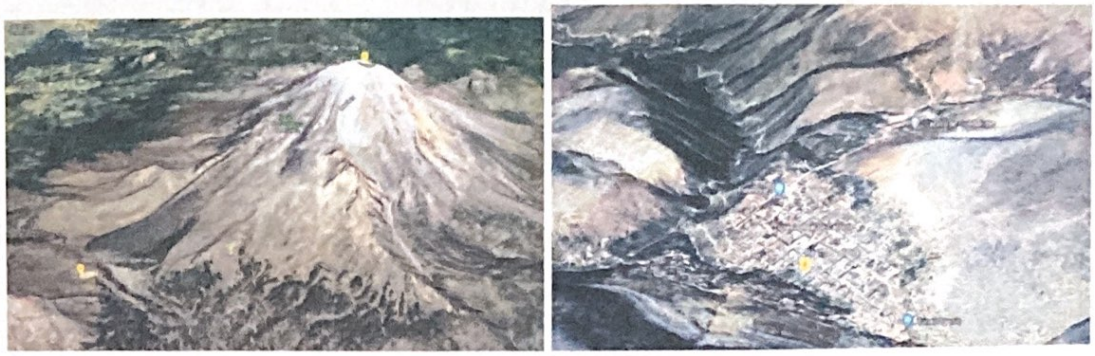


Figure 2: (Left) A physics detector near Pico de Orizaba in Mexico. (Right) A town in central Mexico.

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

3 Asynchronous Activity Review I

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

   It is the HAWC observatory, it detects cosmic rays. When high-energy cosmic ray hits our atmosphere it causes a chain reaction of energy between air molecules until they eventually hit the ground, the detector uses water to detect these events.

2. 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 are mining cities. Colleges were geared towards researching better techniques for mining & metalurgy (useful arts).

3. 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?

   Potosi, in Bolivia. A lot of the world's silver came from Potosi. The Hapsburg Empire owned Potosi. The silver came from the cerro Rico & was transported to Buenos Aires & then shipped to Europe & Africa.

4 Asynchronous Activity Review II

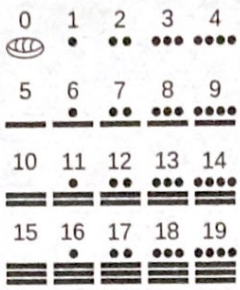


Figure 4: A list of the numerical digits used by the Maya.

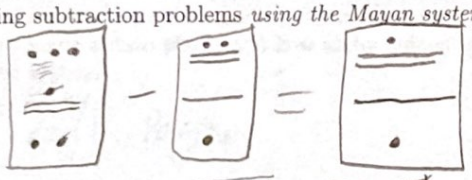
1. Work out the following addition problems *using the Mayan system.*

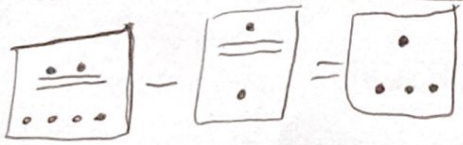
   (a) $80 + 20 =$  (it's addition) -1/2

   (b) $365 + 365 =$ 

   (c) $1024 + 512 =$ 

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

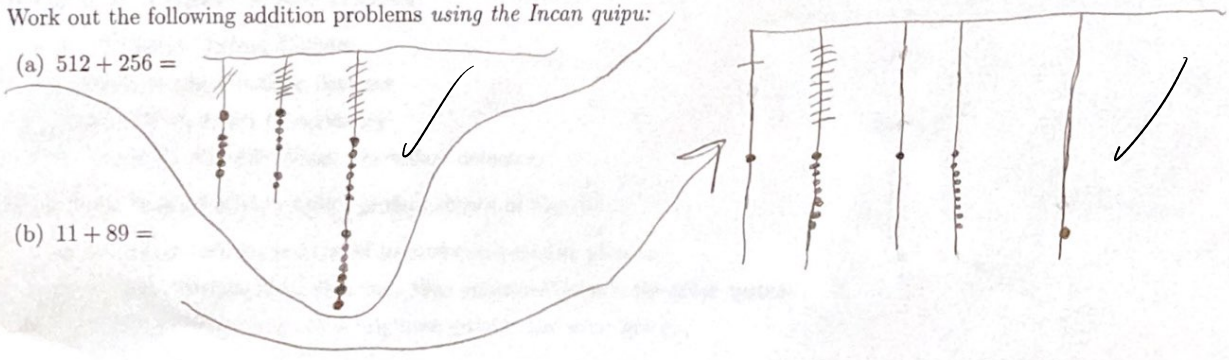
   (a) $1024 - 512 =$ 

   (b) $92 - 31 =$ 

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

   (a) $512 + 256 =$

   (b) $11 + 89 =$



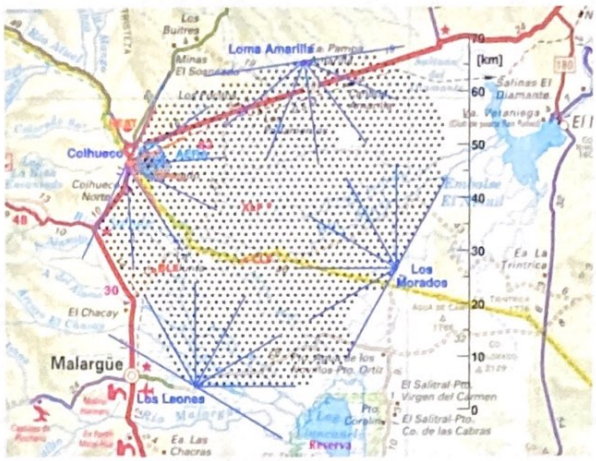
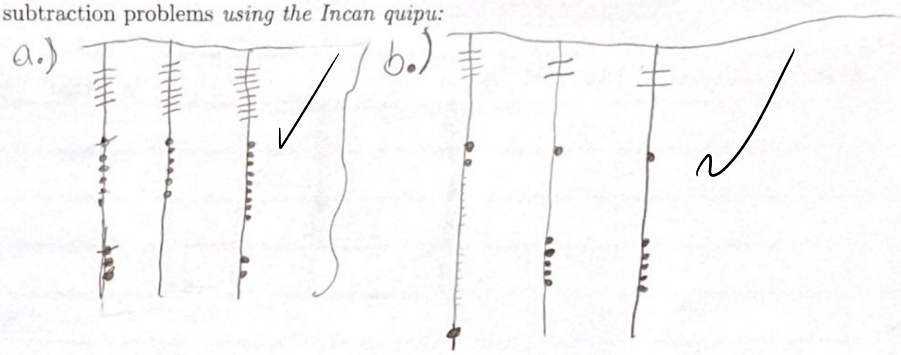


Figure 5: A physics detector near Malargüe, Argentina.

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 that 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.

Answer on next Page.

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

Midterm Question 5

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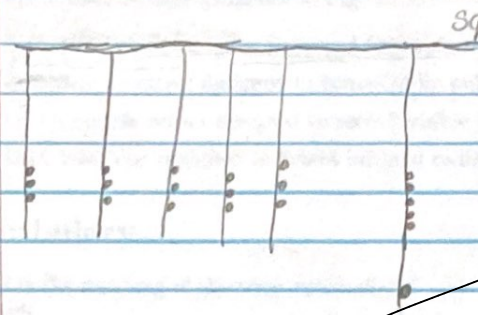
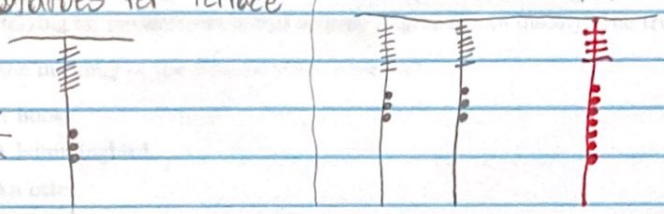
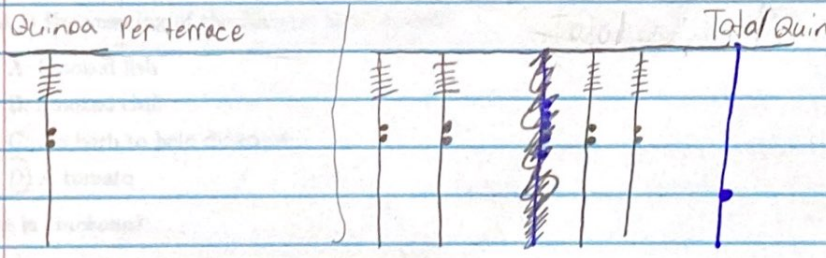


150 ✓

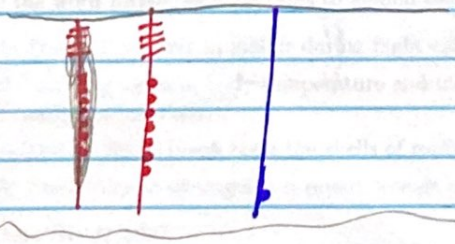
I was thinking 150/(0.2X0.2) potatoes per acre, I



think there was a division error (-½)



Total of each for record



Note: technically 0.8m² would fit in 30m² 37.5 times, but you can't plant half a potato. & it is not said that the 2 terraces are connected as one big terrace, So I will assume that the 2 lower terraces are not connected & cannot share two half slots. Therefore total of 74, instead of 75.

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 guids 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.

The Jesuits were the first to start teaching Newtonian Physics in Nueva Granada. This was a result of them trying to maintain their power, so they needed stronger science to do so. Although some Jesuits did not agree with the new science, such as Francisco Javier Aguilar. Father Aguilar taught a Tychonic Planetary System & referred to the heliocentric system as a hypothesis. However, European professors at the Universities & Academies disseminated Newtonian Physics & the expiditions of La Condamine helped confirm Newtonian Physics & strengthen interest of them.

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.

The aurora borealis is a result of charged particles, from the Sun, crashing into the gases of within our atmosphere. The Aurora of 1789 was significant for several reasons. It was believed that auroras did not happen passed 32° Latitude, but this one was observed Mexico city, which is far below that latitude line, as well as other Mexican cities & cities under 32° latitude around the world. During this aurora scientists in Mexico city & Zacatecas were able to measure the viewing angles & distances to each other to get an estimate of the Altitude of the aurora as well as the atmosphere. There was a scientist named Rangel that was able to do a lab expirement of charging gas particles in a glass tube, which gave a better understanding of the causation of aurora & a better understanding of particle physics.

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.

Cinchona was used to make quinine to treat malaria, tzipipatli was used to treat diarrhea, & Xilo was used to treat wounds. The 4 humors theory broke up blood into 4 categories blood, yellow bile, black bile, & Phlem. These categories were also associated with elemental properties (Air, fire, Earth, water) as well as wetness & temperature. The Europeans tried to classify what medicinal properties American plants based on elemental qualities which influenced how they would use them. The 4 humors theory did not affect indigenous use of medicinal plants since they mostly figured out the uses already.

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.

The church only allowed certain books in libraries, any books not allowed had to be smuggled in & kept in private libraries. Newtonian & Colernican physics was outlawed by the Spanish Inquisition so any research done through these lenses were done illegally & as a result Jesuits were kicked out of Spanish territories as a result of this. Explorers like Cordamine helped create interest in science through his expiditions, & Jesuits decemenated knowledge of more modern sciences like Newtonian physics. The Mexica empire kept records in codices & while most of the knowledge contained in these codices were destroyed, some were preserved & translated by catholic monks. Some of the codices that were translated contained knowledge of the indegeneus understanding of nature.