Midterm - INTD290

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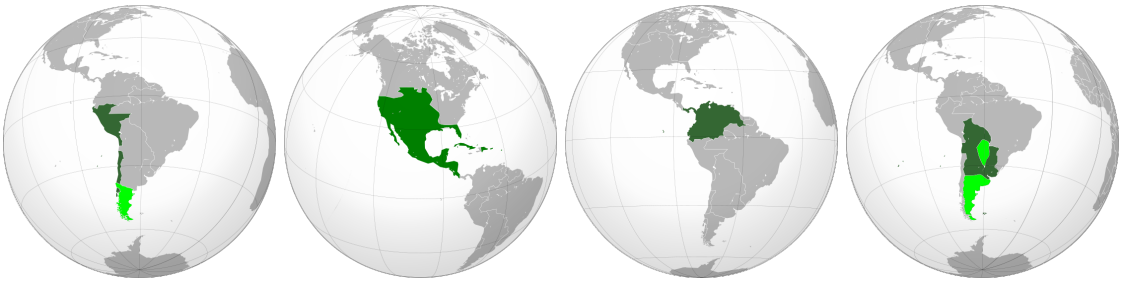
1 How to Submit this Midterm

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



(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? – **Virreinato 2 – New Spain**
2. Which of the four *virreinatos* excelled at the exportation of rum?- **Virreinato 3- Nueva Granada**
3. Which of the four *virreinatos* was characterized by an indigenous empire that mastered agriculture in the Andean mountains?- **Virreinato 1- Peru, the indigenous empire is called Inca**
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, Virreinato 2- New Spain, cities: San Luis Potosi, Oaxaca. Also in Cuba(La Havana) , Russia(Saint Petersburg), Germany(Karlsruhe)**
5. List some of the locations explored by La Condamine and his Latin American collegues, and cite the virreinatoor virreinatos they explored together. – **Main destination: Quito- Virreinato of Peru, also Quenca, basically the citites on the Equator and little bit of Colombia**
6. The Expedici´on Bot´anica of Jos´e Celestino Mutis took place in which virreinato?- **Virreinato of New Granada, Santa Fe**
7. Jos´e 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? – **Verreinato of New Granada, Bogota**
8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been inthe 18th century?- Virreinato 4- **Rio de la Plata, they country is now called Argentina**

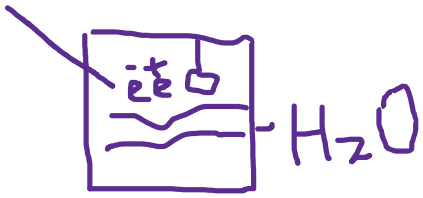
Figure 2: (Left) A physics detector near Pico de Orizaba in Mexico. (Right) A town in central Mexico.

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 andhow it

HAWC Gamma Ray Observatory- Charged particles go through the water tanks and the Gamma Observatory can measure the flashes of light to observe where these charged particles are coming from. The tanks are arranged in way, so they particles arriving could be measured using geometry. It is made to see where the shower particles are coming from



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

Mining(1600's) - The mining was the primary mission of the cities, that's what kept them in such extreme region. The mining was done by hand(horses, ropes) until the late 18^{th} -19^{th} centuries, the silver and other mining metals were used as a currency(1mine could get up to 200000 pesos). The mining region was owned by Habsburg Empire that controlled the Spanish crown and used these mining colonies to fund military expansion.

Mining schools(1700's) have been created first to improve the mining of the regions. People needed more professionals like engineers. Later on the private scientific development took place(early 1700's) and colleges were created in late 1700's. That led to modern science development.

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

San Luis Potosi is located in Mexico, the Verrienado of New Spain . Founded as a Franciscan mission in 1583 and made a city in 1658, San Luis Potosí was the centre of the region's colonial government and mining operations.

Throughout the 17th and 18th centuries, the state remained Mexico's most prolific mining center. In 1772, silver was discovered in the local mountains of Real de Catorce.The mining was possible there due to strategic location of the state, unlike the mining regions up in the mountains, San Luis Potosi had plenty of water and was in the middle between the main cities of Mexico like Guanajuato, which makes this city a efficient in trading. Trading was also possible due to it's location on the trade route Camina real de Tierra. International trade was easier since the city was located closer to the east part of Mexico, allowing them to trade with Europe. Due to high mining activities, many mining schools and later many technological universities like Universidad Autónoma de San Luis Potosí.

4 Asynchronous Activity Review II

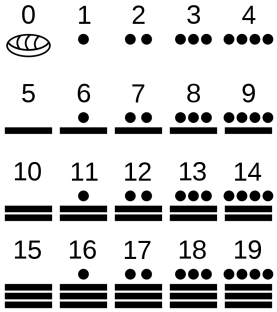
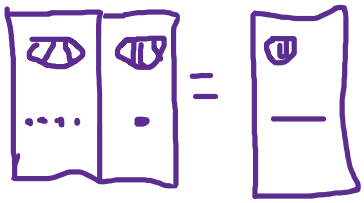


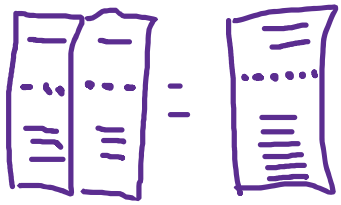
Figure 4: A list of the numerical digits used by the Maya.

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

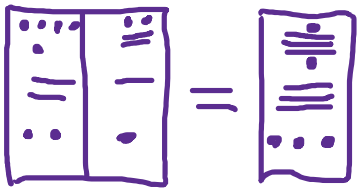
(a) 80 + 20 =



(b) 365 + 365 =

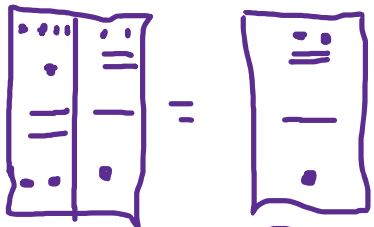


(c) 1024 + 512 =

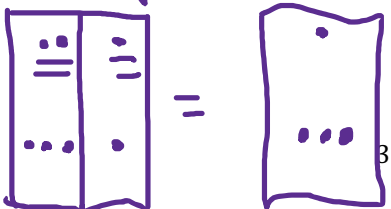


2. Work out the following subtraction problems *using the Mayan system.*

(a) 1024 − 512 =



(b) 92 − 31 =



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

(a) 512 + 256 =

(b) 11 + 89 =

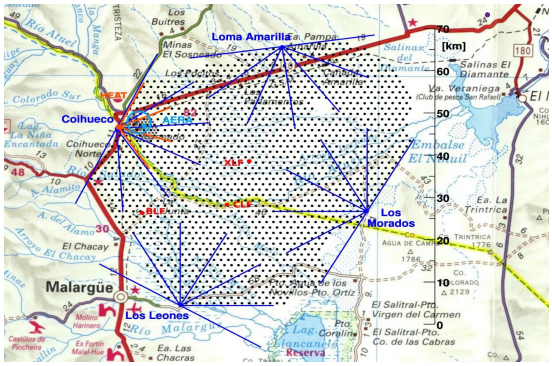


Figure 5: A physics detector near Malargu¨e, Argentina.

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 fellowIncans 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.

$30 \times 5 = 150\,m^2$

$\frac{2}{10\,m} \times \frac{2}{10\,m} = \frac{1}{25}\,m^2$ pots

$= 9750 \times 2 = 7500$ potatos

$\frac{3}{10\,m} \times \frac{3}{10\,m} = \frac{150\,m^2}{\frac{9}{100}\,m^2} = 1666.6 \times 4 = 6666.6$ 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 Pa´ıs*, 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 Peru´ in the late 18th century.

The attempts to introduce and develop enlightenment philosophy came from within the academic environment, by people who were scientists, theorists or just educated people who wanted to develop scientific thought. The education was mostly controlled by Jesuits, Dominican's and the Crown, that were always fighting for monopolization of their way of teaching. Before the crown took over the education, Dominicans and Jesuits could give out degrees, that basically guaranteednot only educational, but also political control. Because of the degrees received, people could occupy the localadministrative positions.

Peru: In the beginning of the 18th century official teachings in Peru like in the Uversidad de San Marcos, continued with strict intellectual orthodoxy and lagged behind in scientific advancement. The advancement started after the famous geo-expedition led by Charles de la Condamine (1736)that arrived in Quito and set a good environment for discussing and developing science. The geodetic mission stimulated the Quito elite's interest in scientific experimentation. Universities like Universidad Gregoriana became one of the first institutions to teach Newtonian physics. Other important steps towards enlightenment were 1786 when Peruvians were able to renovate the university studies in Lima 1791 when Creole doctor Hipolito Unanue established a college of medicine and surgery.

Nueva Granada: Even though it was one Viceroyalty, different cities had different thoughts and speed of developing the enlightenment ideas. Universidad Javeriana -first educational institution that permitted the teaching of Enlightment philosophy (around 1740's) but Universidad de Caracas did not allow the introduction of modern scientific theories until 1788 that were initiated by Professor Baltasar de los Reyes Marrero. The Jesuits, a religious order of the Catholic Church were the first to systematically teach the theories of Newton, Descartes and Copernicus at the Universities of New Granada. One of the main developers of enlightenment ideas in Nueva Granada was Jose Celestiano Mutis, he was an initiator of scientific movement, a botanist and a mentor of a generation of Creole scientists. His work was most important in New Granada and lasted almost 40 years, he considered himself a Copernican and was the one turned Copernicus ideas into life.

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.

Auroras have always fascinated humans and people always strived to find the answer to this phenomena, it pushed people to think scientifically. The aurora of 1789 helped tying physics, chemistry (atmosphere) and led to understanding of what happens when a charged particle goes through matter (Dimas Rangel) . One of the most famous hypothesis was created by Galileo Galilei, famous scientist and on the main initiators of modern scientific thought. He thought that Auroras were due to the sunlight reflecting from the Atmosphere. He coined the term Aurora Borealis after "Aurora" the goddess of the morning. Jose Antonio Alzate also made contributions to studies of Auroras, his comments regarding the northern lights were important, which appeared in the Gazeta de Literature de México on November 19, 1789, with the title "News of the meteor observed in this city on the night of the 14th of the current " Henry Cavendish made quantifiable observations of the aurora in 1790. He used a technique known as triangulation to estimate that the aurora light is produced around 100-130 km in altitude. In 1902-1903 Kristian Birkeland, a Norwegian physicist, concluded from his "terrella experiment" that auroral light was caused by currents flowing through the gas of the upper atmosphere.

2. **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.

The four humours which are yellow bile, black bile, blood and phlegm were the 4 important liquids human's body consisted of. If the humours stayed in balance then a person remained healthy, but if there was too much of one humour then illness occurred. People classified everything that can be ingested as cold/hot, wet/dry. People believed that the 4 humours correspond to the 4 properties and therefore all illnesses could treated by balancing out the 4 humours. For example, if someone has a fever they would have been thought to have had too much blood in their body. The logical cure therefore is to 'bleed' the patient. Another example is use of Cacao, people believed that Cacao could help digestion by moving the bile in the stomach. Also the use of plants was very popular and even had treatments for such diseases like syphilis (Phyllanthus niruri)

3. **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) Catholic Church controlled much of the education in Hispanic America and did not always like the modern science due to it's atheistic views. Universities were prohibited from using Newtonian physics, as well as scientific discoveries by Copernicus and Gallilei. Books like Voltaire were prohibited by the Catholic church due to it's nature to change people's view on authority, it basically explained why people did not need authority and could live without it. Other scientific books were also prohibited, Catholic church did not want people to gain knowledge that could turn them away from present day social structures.

B) Indigenous treatments like Phyllantus niruri that could treat syphilis were prohibited. The reason for prohibiting such cures is that Catholic church believed in different way of healing. They tried to tell people that all illnesses come from God-related issues and that they should be treated according to Catholic traditions. Herbs and cures coming from Indigenous people of Latin America could mess up the healing methods of Catholics, as well as change perceptions of people towards Catholic methods and their truths.

C) The Jesuits, a religious order of the Catholic Church were the first to systematically teach the theories of Newton, Descartes and Copernicus at the Universities of New Granada. Jose Antonio Alzate, a priest and a scientist, made contributions to studies of Auroras, his comments regarding the northern lights were important, which appeared in the Gazeta de Literature de México.

D) Nahuatl medicine was translated to Spanish by Jesuits.