Roger Chen

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

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

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.

The low-latitude aurora of 1789 was observed all across Mexico and further south. These cities were in Virreinato 2. Observations were also made in England, Russia, Spain, Germany.

5. List some of the locations explored by La Condamine and his Latin American colleagues, and cite the virreinato or virreinatos they explored together.

In 1736, La Condamine's expedition arrived in Quito, Ecuador (Virreinato 1).

6. The Expedicioń Botánica of José Celestino Mutis took place in which virreinato?

Virreinato 3

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?

José Celestino Mutis took place in Virreinato 3. *Colegio del Rosario* is located in Bogotá.

8. In which country is the Pierre Auger Observatory located? In which virreinato would this country have been in the 18th century?

The Pierre Auger Observatory is located in Argentina. It would be located in virreinato 4 if it had been in the 18th century.

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.

Figure 2 shows the HAWC Gamma Ray Observatory located near Pico de Orizaba. The purpose of these 300 water Cherenkov (water tank) detectors is to detect electromagnetic radiation from air showers produced by high energy cosmic rays which hit the Earth's atmosphere.

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?

During the 18th century in Mexico, private libraries were the main indicator of the circulation of scientific modernization through books that reflect the ideological changes taking place in the Americas. The Scientific Enlightenment began to spread across viceroyalties and influenced colleges/universities to begin teaching modern science. With new scientific information, the Mexican cities were no longer in the process of formation or subject and began focusing on advancing the home country.

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 originates, and how was it shipped to Europe and Africa?

Figure 3 shows a geographical map of Potosí, Bolivia. It is famous for the Cerro Rico mountain that had an abundance of silver ore and was once responsible for half the world's silver production. Silver was taken on a mule/ llama train to the Pacific coast and was exported to Europe and Africa by ships.

4 Asynchronous Review II

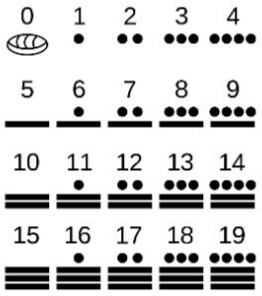
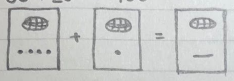


Figure 4: A list of the numerical digits used by the Maya.

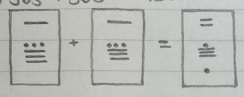
1. Work out the following addition problems using Mayan System

a) 80 + 20 = 100



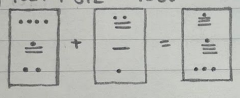
0 × 1 = 0
4 × 20 = 80 } = 80
0 × 1 = 0
1 × 20 = 20 } = 20
0 × 1 = 0
5 × 20 = 100 } = 100

b) 365 + 365 = 730



5 × 1 = 5
18 × 20 = 360 } = 365
10 × 1 = 10
16 × 20 = 320
1 × 400 = 400 } = 730

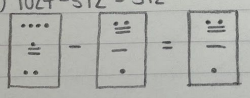
c) 1024 + 512 = 1536



4 × 1 = 4
11 × 20 = 220
2 × 400 = 800 } = 1024
12 × 1 = 12
5 × 20 = 100
1 × 400 = 400 } = 512
16 × 1 = 16
16 × 20 = 320
3 × 400 = 1200 } 1536

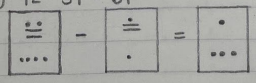
2. Work out the following subtraction problems using Mayan System

a) 1024 − 512 = 512



4 × 1 = 4
11 × 20 = 220
2 × 400 = 800 } 1024
12 × 1 = 12
5 × 20 = 100
1 × 400 = 400 } 512

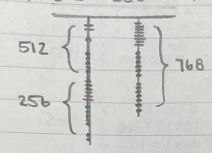
b) 92 − 31 = 61



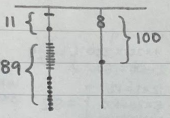
12 × 1 = 12
4 × 20 = 80 } 92
11 × 1 = 11
1 × 20 = 20 } 31
1 × 1 = 1
3 × 20 = 60 } 61

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

a) 512 + 256 = 768

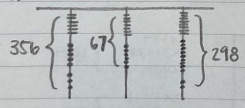


b) 11 + 89 = 100

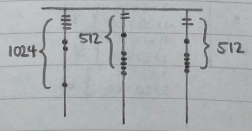


4. Work out the following subtraction problems using Incan quipu:

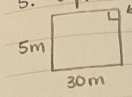
a) 356 − 67 = 298

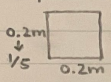


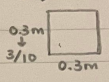
b) 1024 − 512 = 512



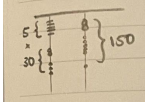
5. 6 plots — 2 potatoes — 4 quinoas





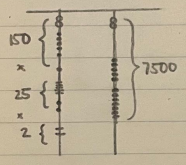


$A = 150 m^2$



$A = 0.04 m^2$ ↓ 1/25

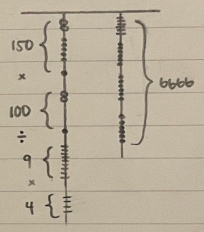
$150 \times 25 \times 2 =$ **7500 potatoes**



$A = 0.09 m^2$ ↓ 9/100

$150 \times \frac{100}{9} \times 4 = 6666.67$

$\approx$ **6666 quinoas**



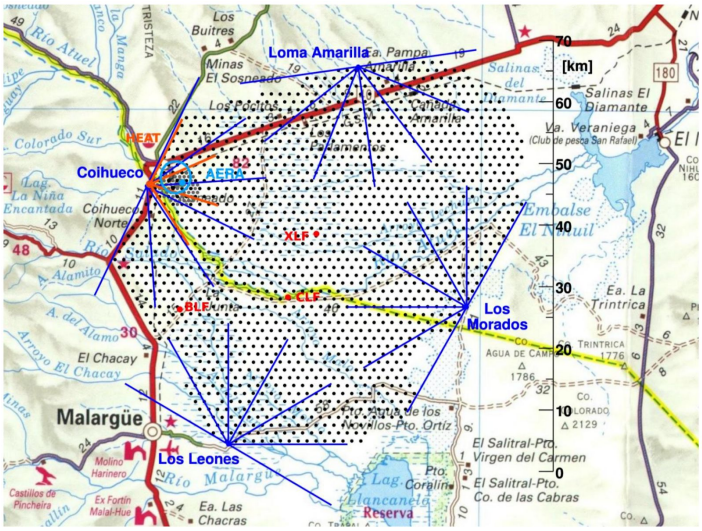


Figure 5: A physics detector near Malargüe, Argentina.

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 subatomic 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 *ahuizotl*?

    - 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 Paˊıs, 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.

Each college and university had their own method of teaching, some of which adapted to the new Enlightenment ideologies and some following the traditional Scholasticism. Universidad Javeriana, for example, was the first educational institution that allowed teaching of Enlightenment philosophy. However, the Universidad de Caracas did not allow the introduction of Copernicus's and Newton's theories until 1788. These efforts to institutionalize Enlightenment thought and scientific knowledge in university classrooms were made by many professors to awaken scientific interest to the university life. In the beginning they were not successful during the colonial period, but eventually their efforts were remarkable.

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 in 1789 was the first low latitude aurora to be studied by three Mexican scientists: Antonio de León y Gama, José Antonio Alzate and Francisco Dimas Rangel. This aurora was circulating around the North Pole and was visible across many cities of Mexico, Texas, Baja California, Russia, the Himalayan mountains and more. Researchers in Europe were not aware that the aurora could be seen in Latin America, which would've been useful in their calculations. Nevertheless, Alzate was able to observe five large sunspots that could've been responsible for the aurora occurring. León y Gama's was able to measure the aurora's height within currently accepted ranges and coincided with the reported color. Dimas Rangel had two valid elements in his Polar Aurora theory model.

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.

The four humors is a medieval theory of medicine based on four fluids within the body. Each humor had an associated color, each color had a temperature and a moisture classification. Medieval scholars associated the humors with the fundamental elements, based on the idea that we consume them to live. Each food item or herb had a classification of hot/cold, and moist/dry. Indigenous treatments were classified into this system, but it did not always fit. Cacao, for example, is a treatment classified as warm and damp but has a third component of being hot and wet. Nevertheless, cacao can be used to help digestion, appetite, bowel movement and urination. A treatment for diarrhea discovered by the Nahua is boiling tzipipatli in water, atole with chia, tortilla xalxocotl fruit, leaves. A treatment for dysentery discovered by Europeans is mixing manure with wine, vinegar, ground pig feet with wine, and dog urine with wine.

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) Voltaire and Rousseau were two writers, intellectuals and scientists who shaped the French Enlightenment during the 18th century. Reading their literary works were explicitly prohibited in Mexico by the Inquisition because they classified them as “heretic authors who sowed ‘mistakes opposed to religion, to good customs, to civil government and the righteous obedience due our legitimate sovereigns and superiors.’” (pg 60) However, there was high demand for books making bookstores a great business which resulted in the intense trade in books that contained enlightenment ideas. To combat the prohibition, private libraries were created as the main source to get enlightenment ideology. These books helped influence many Mexican scientists to write their own scientific journals using new enlightenment ideas which helped increase the spread.

(b) Indigenous treatments is an example of being censored from Latin America to Europe. Had they not censored the information, there could be more treatments to different diseases and would help Europeans prevent any from occurring. Some medicines are related to religious beliefs that by chance also helps cure the disease. It’s the matter of how the medicine is used and interpreted that causes these censorships because it might go against one's culture/beliefs. An example is salvia being used to cure seizure, ulcers, gout, rheumatism, inflammation, dizziness, tremor, paralysis, diarrhea, and hyperglycemia. However, since it’s similar to tobacco by playing with ones mind, the medicine can be abused in a way therefore censoring out the information to the Europeans.

(c) José Antonio Alzate, a cathloic priest, helped contribute to Latin American science by writing and publishing the first scientific journal of the American Enlightenment. Despite how the church keeps censoring his journals, they consisted of information about the physics of the sun, magnetic fields, charged particles, and other scientific enlightenment ideas. HIs contribution helped spark other scientists to seek scientific enlightenment ideas.

(d) Jesuit priests are the ones that helped translate Nahuatl medicine into Spanish for Mexican citizens to gain medical information of indigenous treatments for different diseases. Father Bernardino de Sahagún was a missionary priest that helped translate Nahuatl stories of complex spheres of myth, and fantastical beliefs. The translations helped Mexican citizens become aware of “the great variety of species that existed in Mexico” and each “were carefully classified, serving as an example for some Nahuatl zoological nomenclature.” (pg 43)