Activity Title: Raiders of Machu Picchu

Unit: Conquering Quantity

Submitted by: Gloria Johnson – Mathematics Faculty, DCCC

Description and Purpose: In this lab, students will plan a trip to Peru to visit Machu Picchu. During this lab, students will develop skills in basic research and estimation, start learning Excel, and use dimensional analysis to convert units. Students will also learn about the impact of tourism and contemplate what it means to be a responsible traveler.

Time Needed: Depending on how much the instructor leaves to students outside of class, 1 to 2 class hours will be appropriate for this lab. Students will not finish this lab in class.

Materials For Activity:

- ❖ Raiders of Machu Picchu lab sheet
- ❖ Vacation Budget Starter Excel sheet
- ❖ Internet Access
- ❖ Peru Travel Guide book (optional)

Procedure: This lab should be completed after unit conversion has been introduced. This activity is intended for group work with no lecture component. The instructor is present in class for guidance, but it is possible to do this lab entirely as homework. Ideally, students should read the three online articles listed in question twenty before class. Make sure computers with internet access are available for the class period during which students will work on this lab.

Assessment:

Question(s)	Recommended Points
1 (Excel Budget/Estimation)	20 points
2 – 19 (Unit Conversion)	20 points
20 (Effects of Tourism on Machu Picchu)	10 points
Total Score	**50 points**

Resources:

- Rachowiecki, R., & Beech, C. (2004). *Peru* (5th ed.). Oakland, CA: Lonely Planet.
- **http://www.peru.travel/en-us/**
- **http://www.lonelyplanet.com/peru**
- **http://www.expedia.com**

MAT 143 Lab: Conquering Quantity – Raiders of Machu Picchu

Machu Picchu is a fifteenth-century Incan ruin located in the Andes near the Peruvian city of Cuzco. As one of the few well-preserved pre-Columbian ruins, Machu Picchu was named a UNESCO World Heritage Site in 1983. Today, Machu Picchu is one of the most visited tourist destinations in Peru; but it has only been widely known for about one-hundred years. Hiram Bingham, one of the earliest visitors to the site, is often credited as the scientific discoverer of the Machu Picchu. He returned to Yale University from several archaeological visits to the site with bones and other artifacts over which there is still on ongoing dispute between the Peruvian government and the university. Bingham is often cited as the inspiration for Indiana Jones, and like the fictional scientist, Bingham may be seen as more of a tomb raider than an archaeologist.

In this lab, you will plan a vacation to Cuzco, Peru to hike the Inca Trail and visit Machu Picchu. You will do basic unit conversions using dimensional analysis, use estimation to allot your budget, and learn about Peru. Toward the end of the process, you will also consider what it means to be a responsible visitor rather than a raider of Machu Picchu. Grab your trusty fedora and army surplus bag and hit the road.

YOUR ITINERARY

Day One: Fly to Cuzco, Peru.

Day Two: Enjoy Cuzco. Plan an activity in the city such as visiting a museum, shopping, or visiting a nearby archeological site.

Days Three through Six: Hike the Inca Trail and visit Machu Picchu.

Day Seven: Fly home.

YOUR LAB QUESTIONS

INSTRUCTIONS: Answer each of the following questions in a Microsoft Word document. Correct responses must include units. Answer in complete sentences where indicated. Your file name should have the format "YourNamePeruLab.doc."

1. To celebrate your college graduation, you plan to save $3000 to take a special vacation to Peru. In this part of the lab, you will need to do some research to allocate funds for the different aspects of your trip. You will need to use a website such as Travelocity.com or expedia.com to estimate how much airfare will cost. You may Travelocity, Expedia, or a travel guide from the library to estimate costs of staying in hotels or hostels, day trips around Cuzco, and the cost of hiking the Inca Trail. Travel guides can also help you decide how much you need to set aside for food and souvenirs. You might also take a look at the Explore By Yourself website: **http://www.explorebyyourself.com/en/faq/souvenirs_from_peru/**. Don't forget to include money for gratuities, any special items you might need to acquire for the Inca Trail hike, and emergencies. Once you have completed your research, fill in the Vacation Budget Spreadsheet and use it to total your costs. Remember, you only have $3000, so plan wisely. Save your file as YourNameVacationBudget.xlxs and submit it with your completed lab.

2. Now take a look at your completed budget. You need to decide how much of your budget will be paid in cash during your trip. Remember, even if a place accepts credit cards, there may be hefty

fees for using them. How much money in cash will you need? Explain your answer in a complete sentence.

3. You will need to convert US dollars into Peruvian currency for use during your trip. You can use the site http://www.xe.com to answer questions (a) and (b).
    (a) What is the currency used in Peru?
    (b) What is the exchange rate between Peruvian currency and US dollars?
    (c) Use dimensional analysis and your answer to part (b) to convert your US cash allowance into Peruvian currency.

4. Write your answers to the following questions in complete sentences. You will find www.timeanddate.com/worldclock/difference.html helpful.
    (a) In which time zone is Cuzco, Peru located?
    (b) Does Peru observe Daylight Savings Time?
    (c) You are traveling in May. By how many hours does the time in Cuzco differ from North Carolina?

5. If your flight leaves Piedmont Triad International Airport at 8:30AM on May 23rd and takes 15 hours and 25 minutes to reach Cuzco, Peru, at what time and on what date will you arrive in Cuzco?

6. How long is the Inca Trail in kilometers? Given that 1 mile = 1.61 kilometers, how long is the Inca Trail in miles? Use dimensional analysis and show your work.

7. The first day of the hike, you cover 12 kilometers in 6 hours. What was your average walking speed in miles per hour? Use dimensional analysis and show your work.

8. Using the average walking speed and the length of the Inca Trail calculated in the previous problems, how long should it take you to walk to Machu Picchu? Use dimensional analysis and show your work.

9. What is the highest peak in North Carolina? How tall is it in feet? Write your answer in a complete sentence.

10. How tall, in meters, is the highest peak on the Inca Trail? Write your answer in a complete sentence.

11. Given 1 foot = 0.30 meters, use dimensional analysis to convert the height of the tallest peak on the Inca Trail to feet. Show your work.

12. Which peak is taller, the North Carolina peak or the Peruvian peak? How do you think the Appalachian Mountains in North Carolina differ from the Andes Mountains in Peru?

13. Suppose you are taking your vacation in May. What is the average daytime temperature in degrees Celsius on the Inca Trail during that month?

14. Peru measures temperatures in the Celsius scale, while the United States records temperatures in degrees Fahrenheit. Convert the average temperature on the Inca Trail into degrees Fahrenheit

given that $F = \dfrac{9}{5}C + 32$.

15. How does the temperature in North Carolina compare with the temperature in Cuzco, Peru during May?

16. During your journey, you develop an abscessed tooth and have to visit the dentist. You are prescribed an antibiotic with a dosage of 7.5 mg/kg every six hours. If you weigh 120 pounds and the antibiotic comes in 250 mg tablets, how many tablets should you take each day?

17. If you need to take the pills for five days, how many tablets should the pharmacist give you when she fills your prescription?

Many places like Machu Picchu where no-one lives have large numbers of visitors. Those people affect the place they are visiting, and the more of them there are, the greater the effects of their presence will be. In the next several questions, we'll examine just how many people visit Machu Picchu each day, consider their effect on the site, and contemplate how to be responsible visitors rather than raiders.

18. Machu Picchu currently has about 18000 visitors daily. The area of Machu Picchu is about 13 km^2. Calculate the daily visitor density, or how crowded Machu Picchu is, in daily visitors per square mile.

19. Carrboro is the most densely populated town in North Carolina. Go to ZipAtlas **http://zipatlas.com/us/nc/city-comparison/population-density.htm** and look up the population density of Carrboro in people per square mile. How does this compare with the daily visitor density you calculated for Machu Picchu? Write your answer in complete sentences.

20. The many visitors to Machu Picchu are affecting the environment and people who live near the site. What is being done to help protect Machu Picchu? What is being done to help the people who live in the nearby towns? How can you be a responsible traveler during your visit? Read the following articles and write a paragraph to answer these questions.

    - Can We Protect Machu Picchu? (n.d.). Retrieved March 27, 2015, from **http://www.ethicaltraveler.org/2011/10/can-we-protect-machu-picchu/**
    - Machu Picchu Under Threat From Pressures of Tourism. (n.d.). Retrieved March 27, 2015, from **http://news.nationalgeographic.com/news/2002/04/0415_020415_machu.html**
    - Sacred-Sites International Blog. (n.d.). Retrieved March 27, 2015, from **http://sacred-sites.org/wordpress/2011/09/16/protecting-a-legacy-saving-machu-picchu-by-henna-trewn/**

RESOURCES FOR YOUR LAB

- Rachowiecki, R., & Beech, C. (2004). *Peru* (5th ed.). Oakland, CA: Lonely Planet.
- **http://www.peru.travel/en-us/**
- **http://www.lonelyplanet.com/**peru
- **http://www.expedia.com**
- http://www.xe.com
- http://www.timeanddate.com/worldclock/difference.html
- http://www.historytoday.com/richard-cavendish/discovery-machu-picchu
- http://ngm.nationalgeographic.com/1913/04/machu-picchu/bingham-text