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## INTD 290: Number Systems in pre-Columbian Context

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### 1 How to Submit this Assignment

Once you answer the questions, take a picture of your work and convert it to a PDF. Submit the PDF to the assignment link on Moodle.

### 2 Review of Bases

1. In the first video, we reviewed the base-10 number system. As a warm up, express each of these numbers in expanded form. That is, show how each number is a sum of digits times powers of 10 (the first one is done as an example).

$$\bullet 1024 = 1 \times 10^3 + 0 \times 10^2 + 2 \times 10^1 + 4 \times 10^0$$

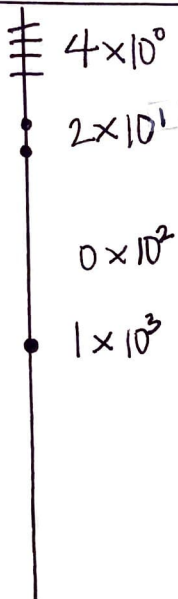
$$\begin{aligned} \bullet 2048 &= 2 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 8 \times 10^0 \\ &\quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ &\quad 2000 + 0 + 40 + 8 \\ &\quad 2,000 + 48 = \boxed{2048} \end{aligned}$$

$$\begin{aligned} \bullet 42 &= 4 \times 10^1 + 2 \times 10^0 \\ &\quad \downarrow \quad \downarrow \\ &\quad 40 + 2 = \boxed{42} \end{aligned}$$

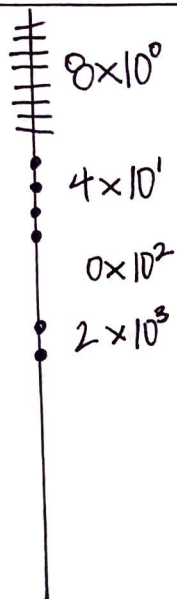
$$\begin{aligned} \bullet 65,536 &= 6 \times 10^4 + 5 \times 10^3 + 5 \times 10^2 + 3 \times 10^1 + 6 \times 10^0 \\ &\quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ &\quad 60,000 + 5,000 + 300 + 6 \end{aligned}$$

2. Draw each of the numbers above as Quipu knot diagrams, as shown in the first video.

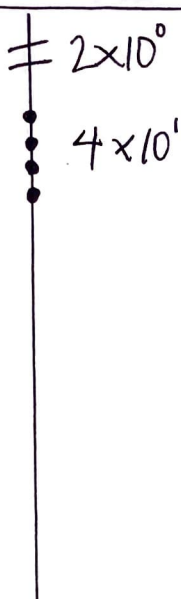
1024



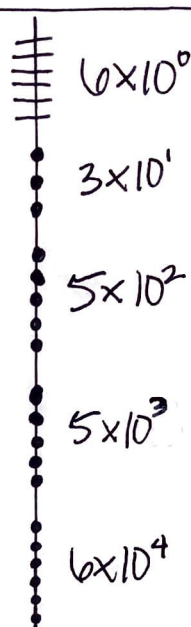
2048



42

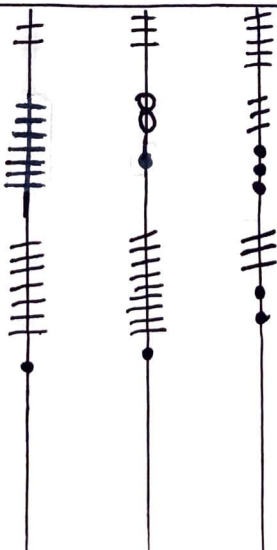


65,536



3. Draw the following table of numbers as a Quipu knot diagram, as discussed in the first and second videos.

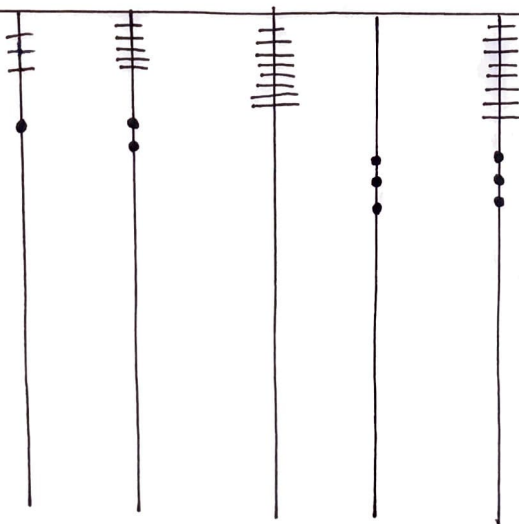
2	3	5
7	11	13
17	19	23



### 3 Accounting Problems

1. Suppose you are an Incan citizen who speaks Quechua, bringing a herd of guanaco to the state office for re- distribution<sup>1</sup>. You are adding thirteen guanaco to the office stables, and there are already twenty-five there. How many are there in total? Write the calculation in the Quipu notation.

$$13 + 25 = 38$$



<sup>1</sup>Fascinatingly, the Inca had no concept of money. A good idea for a final project would be to report on the Inca economic innovation of maintaining an empire without money.

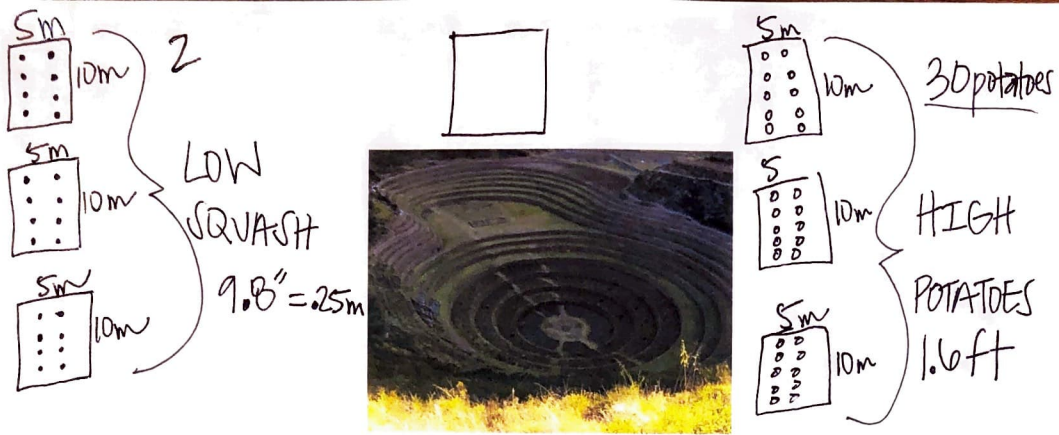
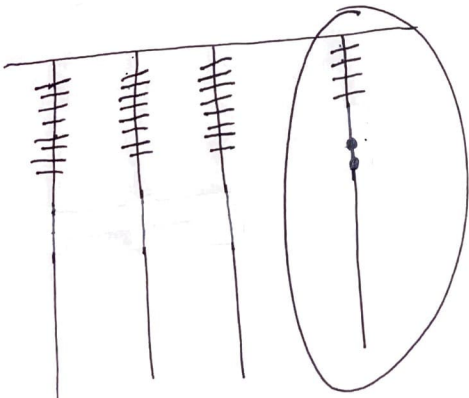


Figure 1: An example of Incan terraces.

2. Suppose you are an Incan agricultural planner who is tasked with designing a farm terrace on a cliffside. The architect informs you that there will be six plots of flat land created, each five by ten meters. The six plots are at two altitudes, three high, three low. The higher altitude is optimal for growing potatoes, while the lower altitude is better for squash. A potato requires a square of earth one-half a meter on a side, while a squash requires a square of earth one-quarter a meter on a side. Use Quipu knot notation as a spreadsheet to determine how many squashes and how many potatoes can be planted. There are many ways to create spreadsheets. Just make sure to tell me how you would interpret your knots.

SQUASH



POTATOES

