This quiz is intended to give you some practice with modular math and RSA. There are 10 questions, each worth 4 points, for a total of 40 points. You will submit your answers in Gradescope for evaluation.

Note: When a question asks for the value $\bmod n$, answers are always given from 0 to n-1 (see the initial lectures on modular arithmetic for that detail).

Question #1:

What is $2^{345} \bmod 31$?

Question #2:

A new Computer Science algorithms course takes 32 weeks to complete. The CS teacher offers to assign you just one second of homework the first week of school, two seconds the second week, four seconds the third, and so on.

How long would the homework take for the last week of school?

Provide your answer in seconds mod 11.

Question # 3:

What is the value $3^{2003} \bmod 5$

Question #4:

What is $13^{-1} \bmod 22$?

Question #5:

Find $(2^{20} + 4^{40} + 5^{50} + 6^{60}) \bmod 7$.

Question #6:

How many numbers between 1 and 143 are relatively prime with 143?

Question #7:

A red ribbon spool has 22,608 inches of ribbon and a blue ribbon spool has 10,206 inches of ribbon. The ribbons on both spools are to be divided into pieces of the same length so that the pieces are as long as possible. What is the length of each piece?

Question #8: (RSA Algorithm)

Your younger brother posts his RSA public key (N = 133, e = 7). You decide to show him that he needs to pick a stronger key. Find your brother's private key.

Question #9: (RSA Algorithm)

Using your brother's RSA Public Key (N=133,e=7), one of his friends sends him the message "5" (the number 5 is the complete message). Decrypt the message to your brother.

Question #10: (RSA Algorithm)

Using p = 3, q = 11, d = 7 and e = 3 in the RSA algorithm, provide the result of encrypting the number 5.