Total points: 30. Total time: 115 minutes. 4 problems over 4 pages. No book, notes, or calculator

1. [10 points]
Suppose Bob uses RSA with n=77 and e=5.
Are these valid numbers for RSA. Explain.
If you answer yes, obtain the corresponding d.

2. [5 points]
Assume that Bob uses RSA and the following hold:

- n=15
- Bob's signature of message m=2 is 5
- Bob's signature of message m=3 is 4

Obtain Bob's signature for the message m=12. Show your derivation here.

3. [5 points]
How many numbers between 1 and 250000 are relatively prime to 250000? Explain

4. [10 points]
Using the efficient algorithm, compute 131^{25} mod-15

5. [10 points]

Obtain a formula that yields a number x in Z_{45} such that x mod-5 = x_1 and x mod-9 = x_2.
Or if you think such a formula does not exist, explain.