

Answers to 4(a):

$n=p*q=35$; $\phi=(p-1)*(q-1)=4*6=24$; as $e=5$;

$e*d \equiv 1 \pmod{24} \rightarrow e*d=24*k+1$, where k are integers; we need to find a value of d that satisfy this equation. By guessing $k = 1, 2$, etc, we can work out the smallest integer of d that satisfy this equation is 5.

Take the first letter, 17,

$M=17^d \pmod{35} = 17^5 \pmod{35} = 17*17*17*17*17 \pmod{35} = (17*17 \pmod{35}) * 17*17*17 \pmod{35} = (9*17 \pmod{35}) * 17*17 \pmod{35} = (13*17 \pmod{35}) * 17 \pmod{35} = (11*17) \pmod{35} = 12$, so the first letter in the received message is 'm'.

$M=19^5 \pmod{35} = 24 \rightarrow 'y'$.

$M=7^5 \pmod{35} = 7 \rightarrow 'h'$.

$M=9^5 \pmod{35} = 4 \rightarrow 'e'$ and so on, you can work out the message is: 'my heart'.

Answers to 4(b) and 4(c):

Basically, public-key cryptosystems are computationally very expensive, much more expensive than symmetric cryptosystems. The larger the plaintexts the longer the encryption/decryption times, and the longer the key sizes, the longer the encryption/decryption times too.