

Homework 6, due September 15

- (1) Find all solutions modulo 17, 97, and 105, respectively, to the congruences $5x + 3 \equiv 9 \pmod{17}$, $18y - 23 \equiv 5 \pmod{97}$, and $14x + 3 \equiv 10 \pmod{105}$. Show your work.
- (2) Suppose that you want to encrypt a message using an affine cipher. You let $a = 0, b = 1, \dots, z = 25$, but you also include $? = 26, ; = 27, " = 28, ! = 29$. Therefore, you use $x \rightarrow \alpha x + \beta \pmod{30}$ for your encryption function, for some integers α and β .
 - (a) Show there are exactly eight possible choices for the integer α (that is, there are only eight choices of α with $0 < \alpha < 30$ that allow you to decrypt).
 - (b) Suppose you try to use $\alpha = 10, \beta = 0$. Find two plaintext letters that encrypt to the same ciphertext letter.
- (3) TIFSYCUG YIVSCYIT B XBYUCFSLBY KCPJTIU TIFSYCUG XYEHIITCEPBLT BU LIBTU
 URI ZEEJ EPIT TII URI MEYLJ JCHHIYIPULG URIG FBPU MBLO CPUE B TUEYI MCURESU
 PEUCFCPZ REM URIG KCZRU TREXLCHU URIG FBPU STI B FEKXSUIY MCURESU MEPJIYCPZ
 BNESU URI TIFSYCUG DSLPIYBNCLCUCIT URIG FBPU DEUI MCURESU UYGCPZ UE HCZSYI
 ESU REM UE DEUI UMCFI URIG QSTU FBPU RILX CU URCT OCPJ EH URCPOCPZ CT PEU
 PBUSYBL HEY KETU XIEXLI CUT PEU PBUSYBL HEY IPZCPIIYT ZEEJ IPZCPIIYCPZ
 CPDELDIT URCPOCPZ BNESU REM URCPZT FBP NI KBJI UE MEYO URI TIFSYCUG KCPJTIU
 CPDELDIT URCPOCPZ BNESU REM URCPZT FBP NI KBJI UE HBCL CU CPDELDIT URCPOCPZ
 LCOI BP BUUBFOIY BP BJDYITBYG EY B FYCKCPBL GES JEPU RBDI UE IAXLECU URI
 DSLPIYBNCLCUCIT GES HCPJ NSU CH GES JEPU TII URI MEYLJ URBG MBG GESLL PIDIY
 PEUCFI KETU TIFSYCUG Xyenlikt