

In-class Assessment 1 - Revisions

1-c) 126

$1 \cdot 2 \cdot \boxed{3 \cdot 3} \cdot 7$

135

$1 \cdot \boxed{3 \cdot 3} \cdot 5$

Greatest common factor of 126 and 135 = 9

2-c) $64 - 2 \cdot 25 = 14$

$25 - 1 \cdot 14 = 11$

$14 - 1 \cdot 11 = 3$

$11 - 3 \cdot 3 = 2$

$3 - 1 \cdot 2 = 1$

$2 - 2 \cdot 1 = 0$

$\Rightarrow \gcd(64, 25) = 1$

3-b) $(13 - 67) \bmod 7$

$= (-54) \bmod 7$

$= (-8 \cdot 7 + 2) \bmod 7$

$\Rightarrow (13 - 67) \bmod 7 = 2$

4.a) The additive inverse of 12 modulo 77 = 65 because
 $(65 + 12) \bmod 77 = 0$ b) The additive inverse of 45 mod 8 = 3 because
 $(45 + 3) \bmod 8 = 0$

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5.a) The multiplicative inverse of 11 mod 26 exists if the greatest common factor of 26 and 11 is 1.

$$\begin{bmatrix} 26 & 1 & 0 \end{bmatrix} - 2 \begin{bmatrix} 11 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 1 & -2 \end{bmatrix}$$

$$\begin{bmatrix} 11 & 0 & 1 \end{bmatrix} - 2 \begin{bmatrix} 4 & 1 & -2 \end{bmatrix} = \begin{bmatrix} 3 & -2 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 4 & 1 & -2 \end{bmatrix} - 1 \begin{bmatrix} 3 & -2 & 5 \end{bmatrix} = \begin{bmatrix} 1 & 3 & -7 \end{bmatrix} \Rightarrow 1 = 3 \cdot 26 + (-7) \cdot 11$$

$$\begin{bmatrix} 3 & -2 & 5 \end{bmatrix} - 3 \begin{bmatrix} 1 & 3 & -7 \end{bmatrix} = \begin{bmatrix} 0 & -11 & 26 \end{bmatrix}$$

\Rightarrow The multiplicative inverse of 11 mod 26 = $-7 \text{ mod } 26 = 19$

$$\begin{array}{r} 11 \qquad 22 \\ \diagdown \qquad \diagup \\ 1 \ 11 \qquad 1 \ 22 \\ \qquad \diagdown \qquad \diagup \\ \qquad 2 \ 11 \end{array}$$

\Rightarrow 11 mod 22 does not have a multiplicative inverse because their greatest common factor is 11 i.e. not 1.

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6.a) Convert the decimal number $(985)_{10}$ to octal

$$985 = 123 \cdot 8 + 1$$

$$123 = 15 \cdot 8 + 3$$

$$15 = 1 \cdot 8 + 7$$

$$1 = 0 \cdot 8 + 1$$

$$\Rightarrow (985)_{10} = (1731)_8$$

6.b) Convert the decimal number $(985)_{10}$ to binary

ref 6a) $985_{10} = 1731_8$

$$\Rightarrow 1731_8 = 001\ 111\ 011\ 001_2$$

6.c) Convert the decimal number $(3725)_{10}$ to hexadecimal (base 16)

$$3725 = 232 \cdot 16 + 13$$

$$232 = 14 \cdot 16 + 8$$

$$14 = 0 \cdot 16 + 14$$

$$\Rightarrow (3725)_{10} = E8D$$

6.f) Convert the hexadecimal number $0xA3C2$ to decimal

$$A3C2 = 10 \cdot 16^3 + 3 \cdot 16^2 + 12 \cdot 16^1 + 2 \cdot 16^0$$

$$= 10 \cdot 4096 + 768 + 192 + 2$$

$$= 41,922$$

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8. a)

J	U	N	G	L	E	E	G	J	L	N	U
K	E	E	P	C	A	A	P	K	C	E	E
L	M	A	N	D	C	C	N	L	D	A	M
I	P	E	R	O	N	N	R	I	O	E	P

Encoded message: A C N P N R K L I C D O E A E E M P

J U N G L E	E	G	J	L	N	U	J	U	N	G	L	E
6	C	R	F	S	U	O	F	O	U	R	S	C
6	D	A	O	N	E	R	O	R	E	A	N	D
6	Y	E	S	N	V	E	S	E	V	E	N	Y
6	S	S	E	I	R	A	E	A	R	S	I	S
6	T	N	A	G	O	L	A	L	O	N	G	T
3			I		E	M	I	M	E			

Decrypted message: four score and seven years is a long time.