

Robert (Robbie) Knowles MATH 135 Fall 2020: WA07

Q01a To start we apply the EEA to create the following table:

x	y	r	q
0	1	8050	0
1	0	1771	0
-4	1	966	4
5	-1	805	1
-9	2	161	1
50	-11	0	5

We can determine from the EEA table above that the $d = \gcd(1771, 8050) = r_5 = 161$. We know from LDET 1 that since 23 is not divisible by 161 (or d) does not divide 23, there will exists no integers x, y such that:

$$1771x + 8050y = 23$$

Q01b Before we begin we will replace y and $-a$, such that the following is equivalent:

$$\begin{aligned} 1197x - 5145y + 42 &\equiv 1197x - 5145(-a) + 42 \\ &\equiv 1197x + 5145a + 42 \end{aligned}$$

Now we willl apply the EEA to create the following table (using the x, a equation):

x	a	r	q
0	1	5145	0
1	0	1197	0
-4	1	357	4
13	-3	126	3
-30	7	105	2
43	-10	21	1
-245	57	0	5

We can determine from the EEA table above that the $d = \gcd(1771, 8050) = r_6 = 21$. We know from LDET 1 that since $21 \mid -42$, integers solutions of x, a exist. The certificate of correctness we obtain from the EEA table is $s = x_6 = 43$ and $t = a_6 = -10$, such that:

$$\begin{aligned} x(s) + a(t) &= 21 \\ 1197(43) + 5145(-10) &= 21 \end{aligned}$$

Since $a = -y$, we can convert this formula back into x, y form ($s = x_6 = 43$, $t = y_6 = -a_6 = 10$):

$$\begin{aligned} x(s) - y(t) &= 21 \\ 1197(43) - 5145(10) &= 21 \end{aligned}$$

Multiplying this by -2 we get:

$$1197(-86) - 5145(-20) = -42$$

We also know from the LDET 2 that we can use the specific solution of $x_0 = -86$ and $y_0 = -20$ to get the set of all solutions:

$$\{(x, y) : x = x_0 + \frac{t}{d}, y = y_0 - \frac{s}{d}\}$$
$$\{(x, y) : x = -86 + 245n, y = -20 + 57n, n \in \mathbb{Z}\}$$