Cairo University Faculty of Engineering		3rd Year Comp. MTH3251- Fall 2022 Number theory - Sheet 3

(1) Solve each of the following sets of simultaneous congruences:
(a) $x \equiv 1 \pmod 3$, $x \equiv 2 \pmod 5$, $x \equiv 3 \pmod 7$.
(b) $x \equiv 5 \pmod{11}$, $x \equiv 14 \pmod{29}$, $x \equiv 15 \pmod{31}$.
(c) $x \equiv 5 \pmod 6$, $x \equiv 4 \pmod{11}$, $x \equiv 3 \pmod{17}$.

(2) Obtain three consecutive integers, each having a square factor. [Hint: Find an integer a such that $2^2|a$, $3^2|a+1$, $5^2|a+2$.]

(3) Obtain three consecutive integers, the first of which is divisible by a square, the second by a cube, and the third by a fourth power.

lazm el arkam el hatakhudha el gcd benhom ykon b wahed ml awl.

(4) A band of 17 pirates stole a sack of gold coins. When they tried to divide the fortune into equal portions, 3 coins remained. In the ensuing brawl over who should get the extra coins, one pirate was killed. The wealth was redistributed, but this time an equal division left 10 coins. Again, an argument developed in which another pirate was killed. But now the total fortune was evenly distributed among the survivors. What was the least number of coins that could have been stolen?

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(5) A certain integer between 1 and 1200 leaves the remainders 1, 2, 6 when divided by 9, 11, 13, respectively. What is the integer?

Midterm

(6) Find the solutions of each of the following systems of congruences:
(a) $5x + 3y \equiv 1 \pmod 7$
$3x + 2y \equiv 4 \pmod 7$.

x = 4, y = 3

(b) $7x + 3y \equiv 6 \pmod{11}$
$4x + 2y \equiv 9 \pmod{11}$.

x=3, y=4

x = 9, y =3

(c) $11x + 5y \equiv 7 \pmod{20}$
$x + 3y \equiv 8 \pmod{20}$.

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