SKETCH OF SOLUTIONS (HOMEWORK VI)

12.- The repunits with an even number of digits.

19.- Let $a = (a_n a_{n-1} \dots a_0)_1 0$ then $a = \sum_{i=0}^{n} a_i 10^i \equiv a_0 + a_1 10 + a_2 100 + 1000(a_3 + a_4 10 + a_5 100) + \dots \equiv (a_0 a_1 a_2) + (a_3 a_4 a_5) + \dots \mod 37$ Therefore a is divisible by 37 iff $(a_0 a_1 a_2) + (a_3 a_4 a_5) + \dots$ is divisible by 37. Using this test we get that $443,692 \equiv 443 + 692 \equiv 1135 \not\equiv 0 \mod 37$ and $11,092,785 \equiv 11 + 92 + 785 \equiv 88 \equiv 0 \mod 37$

22.- Since $88 = 11 \cdot 8$ we must have $8 \mid x42y$ therefore $8 \mid 42y$ therefore $y = 4$ since $11 \mid x424$ we must have $11 \mid 4 - 2 + 4 - x$ i.e. $11 \mid 6 - x$. Therefore $x = 6$

Section 5.5

8.- a) $5 \mod 10$

b) Let $(x_i)_{10}$ be the correct id and $(y_i)_{10}$ be the id with a single error. Then $(x_i)_{10} - (y_i)_{10} \equiv a(x_k - y_k) \mod 10$ with a being either $3, 7$ or 9. Since $3, 7$ and 9 are units modulo 10 a single error can always be detected.

c) A transposition which are not detected are the transpositions of digits x_i and x_j such that $i \mid j \mod 3$ or $x_i \equiv x_j \mod 5$

12.- a) 7 b) 9 c) 7

13.- $0 - 07 - 289905 - 0$

16.- a) 2 b) 4 c) 3 d) 7

17.- Let $(x_i)_{10}$ be the correct UPC code and $(y_i)_{10}$ be the UPC code with a single transposition. Then $(x_i)_{10} - (y_i)_{10} \equiv a(x_k - y_k) \mod 10$ where a is either 3 or 1. Since 1 and 3 are units modulo 10 a single transposition can always be detected.