multiplications at most; with our extremely sluggish computer, that's 66 seconds, roughly one minute!

#37: The determinant is congruent (mod 5) to:

$$\begin{vmatrix} 1 & & & & & \\ 0 & 2 & & * & & \\ 0 & 0 & 3 & & & \\ 0 & 0 & 0 & 1 & & \\ 0 & 0 & 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 & 3 & 0 \end{vmatrix} \text{ exchange} \quad \equiv (-1)\cdot 1\cdot 2\cdot 3\cdot 1\cdot 3\cdot 3 \equiv 54$$

$$\equiv 4 \mod 5$$

hence not 0.

The $*$ stands for all the other entries that don't affect the result.

#38: The question amounts to asking for the largest n such that $10^n \mid 93!$. We need to count prime factors 2 and 5 in

$93! = 1\cdot 2\cdot 3\cdot 4\cdot 5\cdot 6 \cdot \ldots\ldots \cdot 92\cdot 93$

(single) factors 5 come from $5, 10, 15, \ldots 90$; that's $\frac{90}{5} = 18$ factors

But in 25, 50, 75, we undercounted the factors 5: We only counted one, but should have counted two each.

So that's 21 factors 5 altogether.

There are more factors 2, namely more than $\frac{92}{2} = 46$.

Hence $10^{21} \mid 93!$, but $10^{22} \nmid 93!$

There are therefore 21 trailing zeros in 93!