Exercise 33: (Post correspondence problem light)

Exercise 34: (Decidable first-order logic)

a

b

Exercise 35: (Undecidable problem III: Mortal Matrices)

a

This set of matrices is not a set of mortal matrices.
A_1 is just $-1 \cdot \mathbb{E}$, as well as A_2^2, $A_3 \cdot A_2$ and A_3^2, so multiplakation with it will only result in the zero matrix if is multiplied with the zero matrix. Similarly $A_2 \cdot A_3$ is just $\mathbb{E}$. Furthermore, A_3 is just $A_1 \cdot A_2$

b

This set of matrices is a set of mortal matrices.

$$B_1 \cdot B_3 \cdot B_2 \cdot B_1 = Zeromatrix$$

c

From our classes in linear algebra we miraculously remember a useful property of determinants:
given two matrices A and B it holds:

$$det(A * B) = det(A) * det(B)$$

If none of our given matrices' determinants equal zero we won't be able to produce a matrix whose determinant is zero, which also means we won't be able to produce the Zeromatrix.

$$det(C_1) = -1$$
$$det(C_2) = -1$$
$$det(C_3) = 2$$

Since no determinant is zero, this set of matrices is immortal.

Exercise 36: (More Mortal Matrices)

We wrote a small python program (see attachments of the mail) to brute force our way to a solution:

$$A \cdot B \cdot B \cdot A \cdot B \cdot A \cdot A \cdot B \cdot B \cdot B \cdot B \cdot A \cdot A \cdot A \cdot B \cdot B \cdot A = Zeromatrix$$