CS4243 Written Assignment 1

Example of correct answer:

(a).
$$\begin{cases} k_1 r^2 x + k_2 r^4 x = x' - x \\ k_1 r^2 y + k_2 r^4 y = y' - y \end{cases}$$

$$\Rightarrow \begin{bmatrix} r^2 x & r^4 x \\ r^2 y & r^4 y \end{bmatrix} \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} = \begin{bmatrix} x' - x \\ y' - y \end{bmatrix}$$

$\Rightarrow$ for n points.

$$A = \begin{bmatrix} r_1^2 x_1 & r_1^4 x_1 \\ r_1^2 y_1 & r_1^4 y_1 \\ r_2^2 x_2 & r_2^4 x_2 \\ r_2^2 y_2 & r_2^4 y_2 \\ \vdots \\ r_n^2 x_n & r_n^4 x_n \\ r_n^2 y_n & r_n^4 y_n \end{bmatrix}$$

$$v = \begin{bmatrix} x_1' - x_1 \\ y_1' - y_1 \\ x_2' - x_2 \\ y_2' - y_2 \\ \vdots \\ x_n' - x_n \\ y_n' - y_n \end{bmatrix}$$

Example of partially correct answer:

a)
$$v = \begin{bmatrix} x_1' - x_1 \\ \vdots \\ x_n' - x_n \\ y_1' - y_1 \\ \vdots \\ y_n' - y_n \end{bmatrix}$$

b) $A =$
$$\begin{bmatrix} r^2 x_1 & r^4 x_1 \\ \vdots & \vdots \\ r^2 x_n & r^4 x_n \\ r^2 y_1 & r^4 y_1 \\ \vdots & \vdots \\ r^2 y_n & r^4 y_n \end{bmatrix}$$

The r's should be different for different image points, i.e., $r_1, ..., r_n$, instead of just r.

Example of incorrect answer:

The idea is correct but the elements in the matrix are wrong. The dimensions of the matrices are also wrong.

(a) $v = \begin{bmatrix} x' - x \\ y' - y \end{bmatrix}$

(b) $A = \begin{bmatrix} x^3 + xy^2 & x^5 + 2x^3y^2 + xy^4 \\ x^2y + y^3 & x^4y + 2x^2y^3 + y^5 \end{bmatrix}$

Example of correct but not advisable answer:

Rewrite the equations as

$$\frac{x'}{x} = 1 + \kappa_1 r^2 + \kappa_2 r^4$$

$$\frac{y'}{y} = 1 + \kappa_1 r^2 + \kappa_2 r^4$$

Although this is mathematically correct, it is not advisable in implementation because x and y might be zero.