

**Q1**

1.1 Harris corner detector is invariant to translation. Since a corner is a point whose local neighbourhood stands in two dominant and different edge directions. In other words, a corner can be interpreted as the junction of two edges, where an edge is a sudden change in image brightness. And since the corners describe 3D objects corners then the corners will remain the same even if we move our camera (translation)

1.2. Harris corner detector is invariant to rotation. Since a corner is a point whose local neighbourhood stands in two dominant and different edge directions. In other words, a corner can be interpreted as the junction of two edges, where an edge is a sudden change in image brightness. And since the corners describe 3D objects corners then the corners will remain the same even if we rotate our camera

1.3. Harris corner detector is invariant to illumination. Since a corner is a point, whose local neighbourhood stands in two dominant and different edge directions. In other words, a corner can be interpreted as the junction of two edges, where an edge is a sudden change in image brightness.

**Q3**

3.3 A Sobel operator calculates the partial gradients in the X and Y directions. The gradients would get high values on edges because they represent a shift in the frame colors (observed objects), for that the X and Y gradients would find the edges in the X and Y directions accordingly. The sobel operator uses a 3X3 kernel of the sort:

-1	0	1
-2	0	2
-1	0	1

For x. and:

1	2	1
0	0	0
-1	-2	-1

For y

Which are convolved with the original image to calculate approximations of the derivatives