CS 576 Spring 2023 – Assignment 1

Analysis Questions

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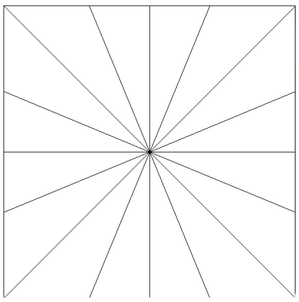
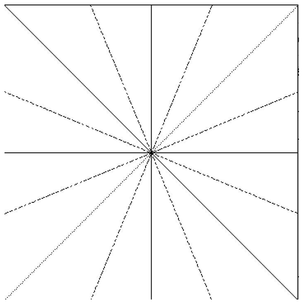
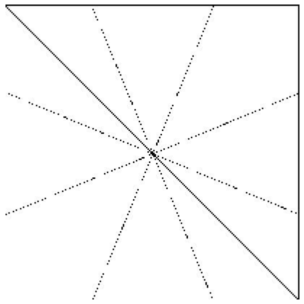
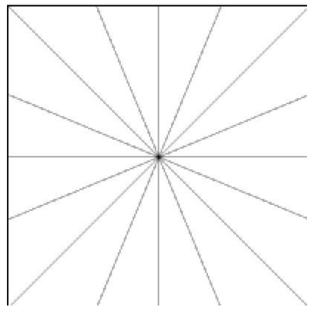
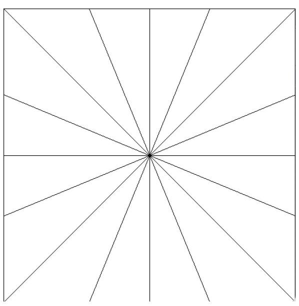
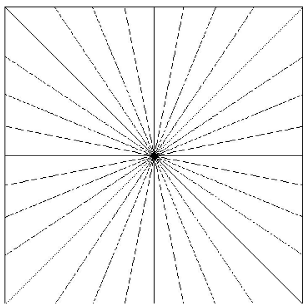
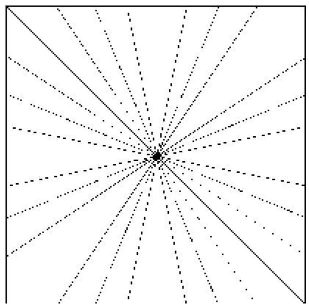
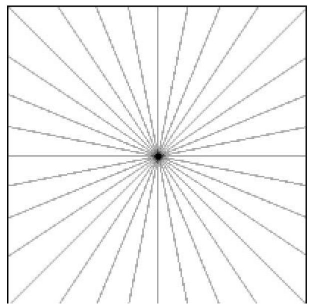
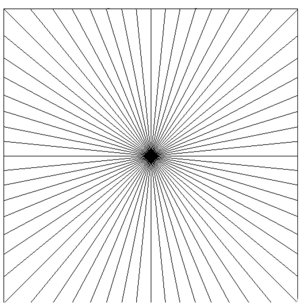
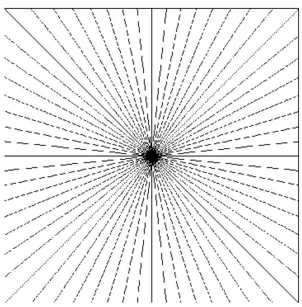
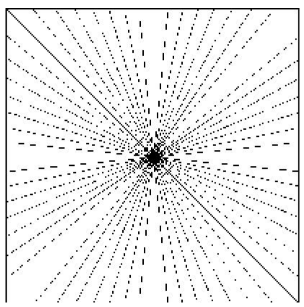
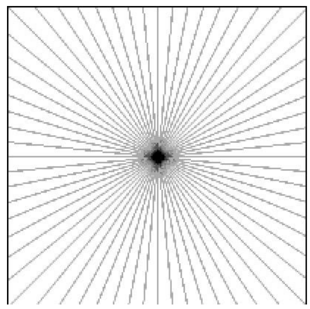
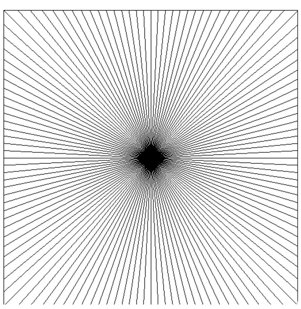
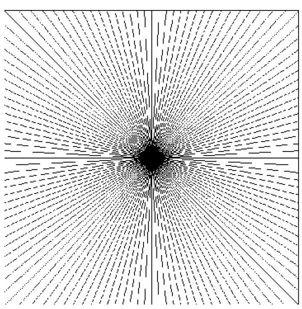
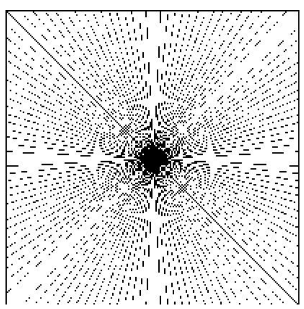
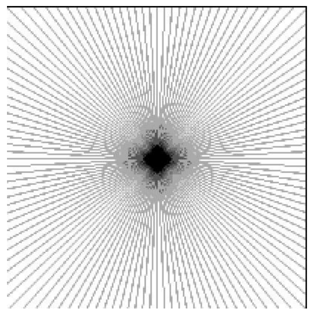
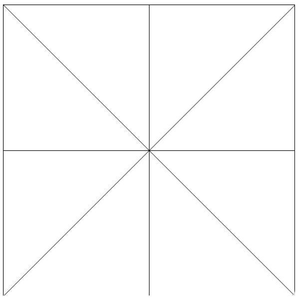
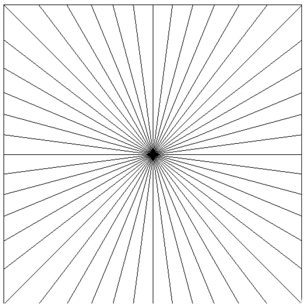
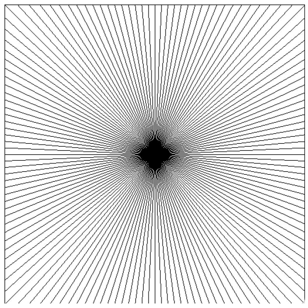
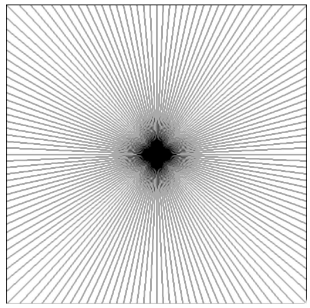
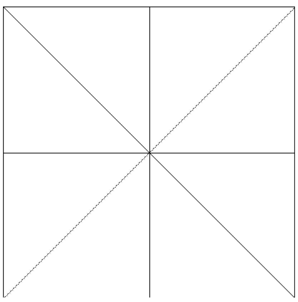
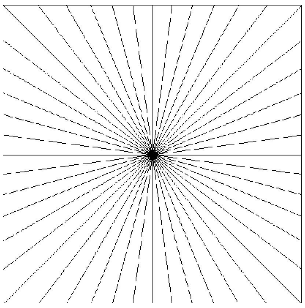
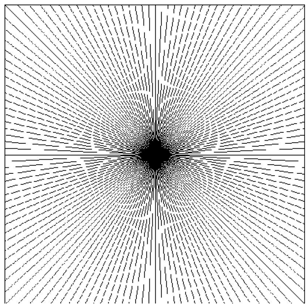
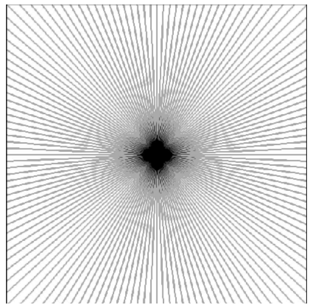
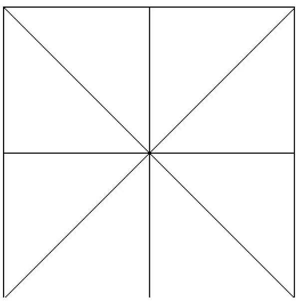
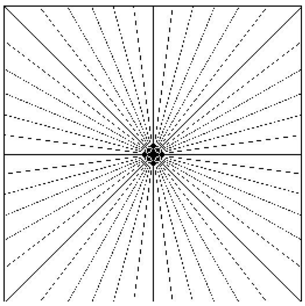
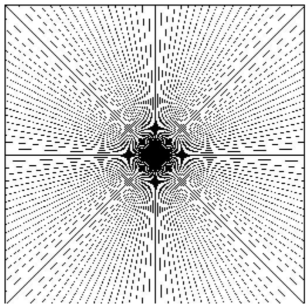
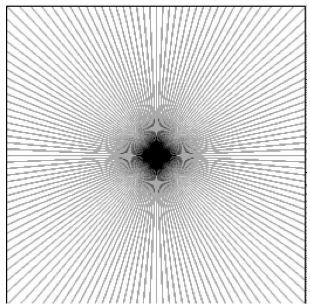
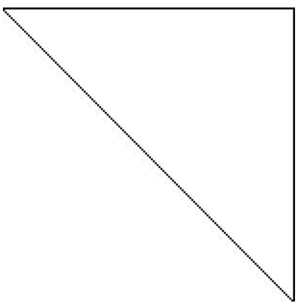
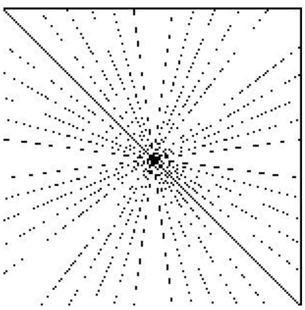
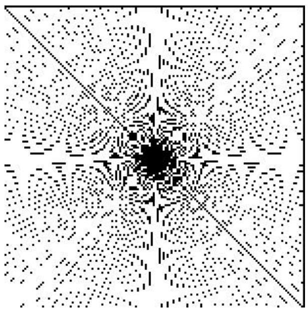
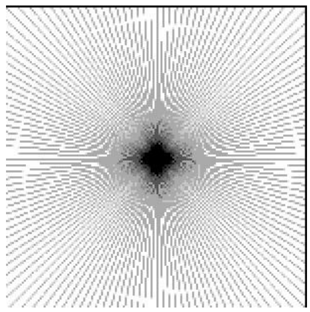
Part 1

1. Let's try an experiment where s (scale factor) remains constant and n (number of lines) is allowed to vary. Comment on your results by using various constant values of *s* for changing *n*. You may attach results, plot charts etc. to qualify your results.

	s=1	s=0.7	s=0.4	s=0.4 (anti-aliasing)
n=16				
n=32				
n=64				
n=128				

By using various constant values of *s* (1, 0.7, 0.4, 0.4 with anti-aliasing) for changing *n* (16, 32, 64, 128), we got the results above. For a given s (scale factor), as n (number of lines) increases, the output image quality decreases, there will be more jagged or staircase appearance in the output.

2. Let's try another experiment, this time keep n (number of lines) constant and varying s (scale factor). Comment on your results by using various constant values of *n* for changing *s*. You may attach results, plot charts etc. to qualify your results.

	n=8	n=48	n=144	n=144 (anti-aliasing)
s=1				
s=0.8				
s=0.5				
s=0.3				

By using various constant values of *n* (8, 48, 144, 144 with anti-aliasing) for changing *s* (1, 0.8, 0.5, 0.3), we got the results above. For a given n (number of lines), as s (scale factor) decreases, (images smaller and smaller), the output image quality decreases, there will be more jagged or staircase appearance in the output.

Part 2

Let's try an experiment where *s* (speed of rotation) remains constant and *fps* (frames per second) is allowed to vary. Study the value of the *os* (observed speed of rotation), especially when there is temporal aliasing.

1. Can you design a formula relating *s*, *fps* and *os*. Evaluate if your formula works for certain values of *s* and *fps*. If *s* = 10 rotations per second,

When $fps >= 2*s$, Nyquist sampling Frequency of rotation = $2*s$, Frame rate of projection $fps > 2*s$. Hence *os* will be *s*.

When $fps < 2*s$, there will be temporal aliasing. The formula could be:

$os = (360 - (s * 360 / fps)) * fps / 360, \quad \text{if } (s * 360 / fps) \% 360 >= 180$

$os = ((s * 360 / fps) \% 360) * fps / 360, \quad \text{if } (s * 360 / fps) \% 360 < 180$

2. What is the observed speed *os* for an *fps* of 25?

When *s* = 10 rotations per second, fps = 25, then $fps >= 2*s = 20$

So the observed speed os would be 10

3. What is the observed speed *os* for an *fps* of 16?

When *s* = 10 rotations per second, fps = 16, then $fps < 2*s = 20$

$(s * 360 / fps) \% 360 = 225 >= 180$

$os = (360 - (s * 360 / fps)) * fps / 360$

$= (360 - (10 * 360 / 16)) * 16 / 360$

$= (360 - 225) * 16 / 360$

$= 6$

So the observed speed os would be 6

4. What is the observed speed *os* for an *fps* of 10?

When *s* = 10 rotations per second, fps = 10, then $fps < 2*s = 20$

$(s * 360 / fps) \% 360 = 0 < 180$

$os = ((s * 360 / fps) \% 360) * fps / 360$

$= ((10 * 360 / 10) \% 360) * 10 / 360$

$= 0 * 10 / 360$

$= 0$

So the observed speed os would be 0

5. What is the observed speed *os* for an *fps* of 8?

When *s* = 10 rotations per second, fps = 8, then $fps < 2*s = 20$

$(s * 360 / fps) \% 360 = 90 < 180$

$os = ((s * 360 / fps) \% 360) * fps / 360$

$= ((10 * 360 / 8) \% 360) * 8 / 360$

$= 90 * 8 / 360$

$= 2$

So the observed speed os would be 2