

# Task 2 Camera Sensor and Digital Image

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## Problem 1

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A good image sensor should be big in size, as bigger sensors can fit more pixels and the size of the pixels can also be improved. As the pixels are made larger, they can hold more light in relation to the noise created by the sensor through its operation, and a higher ratio in favour of the signal produces a cleaner image. A good camera also needs to be able to isolate objects and provide more background blur, provide high resolution, good low-light performance, wide dynamic range, low crop factor and less diffraction.

The high-end DSLR cameras are expensive for several reasons: 1) They have very good image sensors which are often big in size and can fit more pixels but still with a portable size; 2) They tend to have more options provided to customize settings to suit different shooting styles; 3) the shutter mechanism itself is complicated as it needs to move the mirror and open the aperture. The mechanism needs to work and speed and be ready for long-time use.

## Problem 2

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Optical zoom on a camera can bring the image closer before capturing it. This is done by moving different lens parts relative to each other. It can bring you closer to the image without losing quality. Digital zoom on a camera zooms in on a specific part of the image and increase it to the total number of megapixels of the camera. Other parts of the image is cropped out. This process is done after the picture is taken.

## Problem 3

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Shutter speed or exposure time is the length of time when the digital sensor inside the camera is exposed to light. The amount of light reaches the sensor is proportional to the exposure time.



Metadata	Image 1	Image 2
Image		
Make	Canon	Canon
Model	EOS 5D Mark IV	EOS 5D Mark IV
Data and time	2019:02:09 03:25	2019:02:09 03:26
Image file type	JPEG	JPEG
Resolution	6720 x 4480	6720 x 4480
Focal length	45 mm	45 mm
Exposure	1/25	1
ISO	100	100
F-number	5	5
GPS	None	None
Flash	Off	Off

Image 2 has an exposure time that is 25 times of that of Image 1. With longer exposure time, more light is captured by the sensor, which makes the image way more brighter. However, with increasing brightness, the noise increases and more details are lost in Image 2. The outline of the object can hardly be seen in this case.

## Problem 4

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Aperture is a hole within a lens, through which light travels into the camera body. Aperture can affect the exposure and depth of field.





Metadata	Image 1	Image 2
Image		
Make	Canon	Canon
Model	EOS 5D Mark IV	EOS 5D Mark IV
Data and time	2019:02:09 03:25	2019:02:09 03:27
Image file type	JPEG	JPEG
Resolution	6720 x 4480	6720 x 4480
Focal length	45 mm	45 mm
Exposure	1/25	1/25
ISO	100	100
F-number	5	11
GPS	None	None
Flash	Off	Off

Image 1 has a f-number of 5 and Image 2 has a f-number of 11. The bigger the f-number, the smaller the size of aperture. Smaller aperture allow less light to pass through, thus Image 2 is darker than Image 1. Adjusting aperture also changes the depth of field. The darkness would mist some of the details along the edges of the image, but this allow the object at the center to be the emphasis of the image.

## Problem 5

ISO is a camera setting that adjusts exposure and brighten/darken a photo. High ISO also causes more noise.

Metadata	Image 1	Image 2
Image		
Make	Canon	Canon
Model	EOS 5D Mark IV	EOS 5D Mark IV
Data and time	2019:02:09 03:25	2019:02:09 03:28
Image file type	JPEG	JPEG
Resolution	6720 x 4480	6720 x 4480
Focal length	45 mm	45 mm
Exposure	1/25	1/25
ISO	100	320
F-number	5	5
GPS	None	None
Flash	Off	Off

Adjusting ISO also changes the brightness of the photo as higher ISO indicates higher sensitivity of the image sensor. More light is captured by the digital image sensor and thus increase the brightness of the photo.

# Problem 6

A flash is a device used in photography producint a flash of artificial light to help illuminate a scene when it is too dark.





Metadata	Image 1	Image 2
Image		
Make	Canon	Canon
Model	EOS 5D Mark IV	EOS 5D Mark IV
Data and time	2019:02:09 03:25	2019:02:09 03:30
Image file type	JPEG	JPEG
Resolution	6720 x 4480	6720 x 4480
Focal length	45 mm	45 mm
Exposure	1/25	1/25
ISO	100	100
F-number	5	5
GPS	None	None
Flash	Off	On

Image 2 is taken with the flash on. The flash provides supplement light and help to illuminate the whole scene. It is usually turned on when the surrounding environment is too dark but we still need enough details.

# Problem 7

The focal length of an optical system is a measure of how strongly the system converges or diverges light.

Metadata	Image 1	Image 2
Image		
Make	Canon	Canon
Model	EOS 5D Mark IV	EOS 5D Mark IV
Data and time	2019:02:09 03:25	2019:02:09 03:30
Image file type	JPEG	JPEG
Resolution	6720 x 4480	6720 x 4480
Focal length	45 mm	24 mm
Exposure	1/25	1/25
ISO	100	100
F-number	5	5
GPS	None	None
Flash	Off	Off



Change in focal length is using the optical zoom of the camera. As discussed before, optical zoom on a camera can bring the image closer or further without losing quality. Image 2 has a focal length of 24 mm, which is smaller than that of Image 1 (45 mm). A shorter focal length is associated with lower magnification and a wider

angle of view. Adjustment of focal length usually depends on how far the subject is and how wide the angle needs to be.

## **Problem 8**

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Field of view is the observable area a person can see via an optical device. It is a solid angle through which a detector is sensitive to electromagnetic radiation.

Metadata	Image 1	Image 2
Image		
Make	Canon	Canon
Model	EOS 5D Mark IV	EOS 5D Mark IV
Data and time	2019:02:09 03:25	2019:02:09 03:30
Image file type	JPEG	JPEG
Resolution	6720 x 4480	6720 x 4480
Focal length	45 mm	105 mm
Exposure	1/25	1/25
ISO	100	100
F-number	5	5
GPS	None	None
Flash	Off	Off

Changing the field of view can be done through different methods. One of them is to change the focal length, which is shown here in Image 2. Image 2 has a greater focal length of 105 mm, so the subject is magnified and a narrow angle of view is provided.