2020 Computer Vision Final Exam ID:

"나는 하나님과 사람 앞에서 한 점 부끄럼 없이 시험에 응하였음을 확인합니다"

"I hereby testify before God and men that all of the answers are my own, and I have taken the exam to the best of my ability without resorting to unethical conduct"

Signature _____

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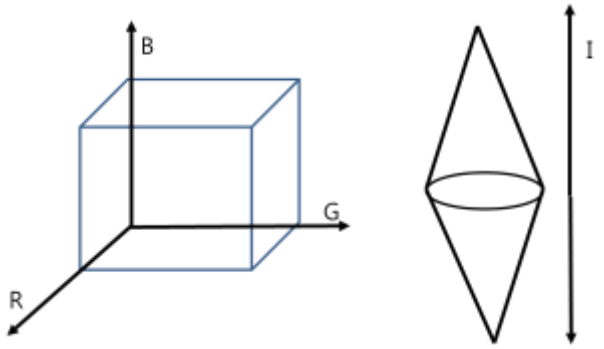
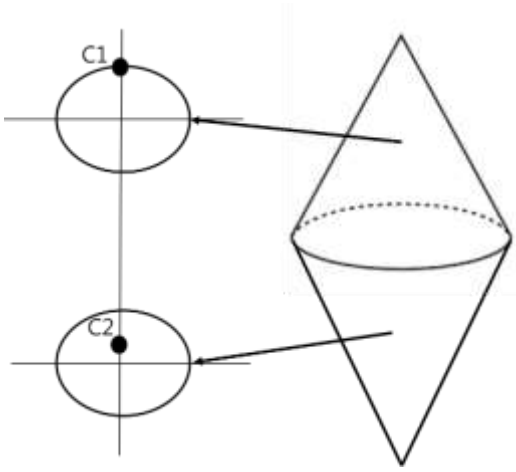
1. Calculate the amount of memory required to store a Full HD color video (frame rate=30fps, 3channels, intensity level=256) whose length is 1 hour. (1pt)

2. Mark the location of achromatic color in the following RGB color space and HSI space. (1pt)



3. Compare Hue, Saturation, and Intensity value of C1 and C2 shown below. (1pt)



4. Explain the effect of gamma transform when i) gamma is below 1, and ii) gamma is above 1. (1pt)

5. Perform negative transformation on the image below. Assume the range of pixel is from 0 to 99. (1pt)

src

10	15	20	25
45	40	35	30
50	55	60	65
85	80	75	70

nagative

6. How should we change 3rd and 4th parameter to obtain less edges (more accurate edges)? (1pt)

Void Canny(InputArray image, OutputArray edges, double threshold1, double threshold2, int apertureSize=3, bool L2gradient = false)

7. How should we change 5th parameters to obtain more lines? (1pt)

void **HoughLines**(InputArray **image**, OutputArray **lines**, double **rho**, double **theta**, int **threshold**, double **srn**=0, double **stn**=0)

8. The code is written to display R-channel of 'lena.png'. Modify all the errors in the code. (1pt)

```
int main()
{
    Mat src = imread("lena.png", 0);

    imshow("R", yuvChannels[0]);

    waitKey(0);
    return 0;
}
```

9. Modify the code such that it displays the input video at double speed. (1pt)

```
int main(){
	Mat frame;

	VideoCapture cap("example.avi");

	double fps = cap.get(CAP_PROP_FPS);

	while (1) {
		cap >> frame;

		imshow("Window", frame);

	}
}
```

10. Compute a normalized histogram for the input image. Assume dynamic range of the input is from 0~31, and the number of bins is 8. (1pt)

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
24	25	26	27	28	29	30	31
24	25	26	27	28	29	30	31

11. Perform spatial filtering on the pixels of the image whose value is written in bold. (2pts)

5	10	15	20	25
30	35	**40**	**45**	50
55	60	**65**	**70**	75
80	85	90	95	100
105	110	115	120	130

0	1/5	0
1/5	1/5	1/5
0	1/5	0

40 → 45→ 65 → 70→

12. Perform 3X3 median filtering on the pixels of the image in problem 6 whose value is written in bold. (2pts)

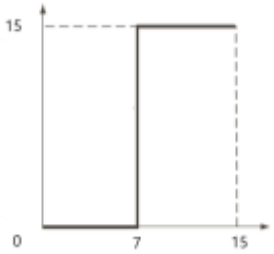
40 → 45→ 65 → 70→

13. Perform white balancing of the image below by using gray-world assumption. Assume dynamic range of the input is from 0~31. (2pts)

0	1	2	3
8	9	10	11
16	17	18	19
24	25	26	27
24	25	26	27

14. Perform intensity transformation according to the given graph. (2pts)

15	10	14	14
8	2	2	14
6	2	2	14
15	12	0	10



15. Perform sharpening on the pixels of the input image whose value is written in bold. For the generation of un-sharp mask, use the given filter. Set all coefficients as 1 for sharpening using un-sharp masking. (2pts)

0	5	10	35	40
0	5	10	30	40
0	5	**10**	**30**	40
0	5	**5**	**25**	40
0	5	5	25	40

0	1/5	0
1/5	1/5	1/5
0	1/5	0

16. We are going to perform edge linking using Hough transform. Edge extraction is already done, and there exist N edge points in a binary image. We subdivide ρθ-space into accumulator cells by Y and X sections, respectively. Then, what is i) the number of visits of the accumulator cells (revisiting is also counted) and ii) the maximum value that accumulator cells can have after Hough transform? (2pts)

17. Obtain the magnitude of gradient of the pixels in bold in the input image by using two kinds of Sobel mask. When you calculate magnitude of gradient, use $mag(\nabla f) = |g_x| + |g_y|$. (2pts)

Input

5	5	5	5	5
10	**10**	**10**	10	10
10	**10**	**10**	10	10
10	10	10	10	10
15	15	15	15	15

Sobel mask1

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

Sobel mask 2

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