CIS5200: Machine Learning	Spring 2023
Homework 0	
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1 Written Questions

A1

1. False.

2. False.

3. False. $(AB)^T = B^T A^T$

4. True.

A2

1. rank = 2

2. min span is [1, 2, 3] [0, -3, -2]

A3

1. $det(A - \lambda I) = 0$ $\lambda_1 = 6$ $v_1 = [1, 1, 1]$, and two more eigenvalues

2. No. it have negative eigenvalue

3. $\lambda_1 = 6a + 1$ $v_1 = [1, 1, 1]$

4. $\lambda^2 = 36$

A4

1. w

2. $-2(y - w^T x) * w$

3. $-y * w * (exp(-yw^T x)/(1 + exp(-yw^T x)))$

4. $2Ax$

A5

1. b = 0

2. distance $= \frac{|w^\intercal x_0 + b|}{|w|}$

A6

1. true

2. true

3. false

4. true

A7

1. No. the hessian is not positive semi-definite

2. x1, x2 all equals to 0, or x1 = 0 $x_2 = \pm\sqrt{\frac{1}{2}}$

3. -3/8

A8   solved by Bayes rule

$$P(sunny/forcastSunny) = \frac{P(forcastSunny/sunny) * P(sunny)}{P(forcastSunny)}$$

$$P(sunny) = 0.1, P(-sunny) = 0.9$$

$$P(-for/sunny) = 0.15, P(for/sunny) = 1 - P(-f/s) = 0.85, P(f/-s) = 0.05$$

$$P(for) = P(f/s) * P(s) + P(f/-s) * P(-s) = 0.85 * 0.1 + 0.05 * 0.9 = 0.13$$

$$P(sunny/for) = \frac{P(for/s) * P(s)}{P(for)} = \frac{0.85 * 0.1}{0.13} = 0.65$$

A9

1. $a = \frac{1}{\sigma}$ $b = -\frac{\mu}{\sigma}$
2. $E[z^2] = var(z) + (E[z])^2 = \sigma^2 + \mu^2$
3. $N(\mu + \bar{\mu}, \sigma^2 + \bar{\sigma}^2)$

A10

1. 1/p
2. independent event, so also p