# SMAI-M20-Lec 14 Review questions

IIIT Hyderabad

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# Review Question - I (one, none or more correct)

Given a set of 2D points $X$ on a line that makes 45 degree to the x-axis:

$$X = \{[1,1]^T, [2,2]^T, [3,3]^, [4,4]^T, [5,5]^T\}$$

We compute the covariance matrix, and its eigen values and eigen vectors. Then:

1. $\lambda_2 = 0$
2. $\lambda_1 = \lambda_2$
3. $\lambda_1 = -1$
4. $\Sigma$ is singular
5. none of the above

Ans: AD

# Review Question - II (one, none or more correct)

Given a set of 2D points $X$ on a line that makes 45 degree to the x-axis:

$$X = \{[-2,2]^T, [-3,3]^,[-4,4]^T, [-5,5]^T[-6,6]^T\}$$

We compute the covariance matrix, and its eigen values and eigen vectors. Then:

1. $\lambda_2 = 0$
2. $\lambda_1 = \lambda_2$
3. $\lambda_1 = -1$
4. $\Sigma$ is singular
5. none of the above

Ans: AD

# Review Question - III (one, none or more correct)

Given a set of 2D points $X$ on the vertical line $x_1 = 5$,

$$X = \{[5,1]^T, [5,2]^T, [5,3]^, [5,4]^T, [5,5]^T\}$$

We now add an additional point $[4,3]^T$ to $X$.
We compute the covariance matrix, and its eigen values and eigen vectors. Then:

1. $\lambda_1 \geq \lambda_2$
2. $\mathbf{u}_1$ and $\mathbf{u}_2$ are nearly orthogonal, but not perfectly orthogonal.
3. $\Sigma$ is singular
4. $\Sigma$ is diagonal
5. None of the above.

Ans: AD

# Review Question - IV (one, none or more correct)

Given a set of 2D points $X$ on the vertical line $x_2 = 5$,

$$X = \{[1,5]^T, [2,5]^T, [3,5]^, [4,5]^T, [5,5]^T\}$$

We compute the covariance matrix, and its eigen values and eigen vectors. Then:

1. $\lambda_1 \geq \lambda_2$
2. $\mu$ is on the same line.
3. $\Sigma$ is singular
4. $\Sigma$ is diagonal
5. None of the above.

Ans: ABCD

# Review Question - V (one, none or more correct)

Set $X$ has 10 points. 5 of them are on a line that makes 45 degrees with the $x_1$ axis and another 5 from on a line that makes 135 degrees with the $x_1$ axis.
We compute the covariance matrix, and its eigen values and eigen vectors. Then:

1. $\lambda_1 = \lambda_2 \neq 0$
2. $\Sigma$ is singular
3. $\Sigma$ is diagonal
4. $\mu$ is on either of these lines.
5. None of the above

Ans: E