Assignment 4 part 1 of 2:

Question 1:

Consider the following two-dimensional data set: $\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 2:

Consider the following two-dimensional data set: $\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

```
Step 1: Find the mean vector
μ = (x̄1, x̄2) = (3, 1.5)
Step 2: Subtract the mean
B = {(-2,-0.5), (-1,-0.5), (0,-0.5), (1,-0.5), (2,-0.5), (-2,0.5), (-1,0.5), (0,0.5), (1,0.5), (2,0.5)}
Step 3: Calculate the covariance matrix
Cov(x1, x1) = ((-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2 + (-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2)/9 = 20/9 = 2.2
Cov(x2, x2) = ((-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2)/9 = 2.5/9 = 0.28
Cov(x1, x2) = ((-2)(-0.5) + (-1)(-0.5) + 0(-0.5) + 1(-0.5) + 2(-0.5) + (-2)(0.5) + (-1)(0.5) + 0(0.5) + 1(0.5) + 2(0.5))/9 = 0/9 = 0
Cov = [2.2  0
       0   0.28]
Step 4: Find the eigenvalues
λ1 = 2.2
λ2 = 0.28
Step 5: Find the eigenvectors
v1 = [1
      0]
v2 = [0
      1]
Step 6: Normalize the eigenvectors
v1 = [1
      0]
v2 = [0
      1]
Step 7: Find the principal components
PC1 = [1
       0]
PC2 = [0
       1]
```

Question 3:

Consider the following two-dimensional data set: $\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

```
Step 1: Find the mean vector
μ = (x̄1, x̄2) = (3, 1.5)
Step 2: Subtract the mean
B = {(-2,-0.5), (-1,-0.5), (0,-0.5), (1,-0.5), (2,-0.5), (-2,0.5), (-1,0.5), (0,0.5), (1,0.5), (2,0.5)}
Step 3: Calculate the covariance matrix
Cov(x1, x1) = ((-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2 + (-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2)/9 = 20/9 = 2.2
Cov(x2, x2) = ((-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2)/9 = 2.5/9 = 0.28
Cov(x1, x2) = ((-2)(-0.5) + (-1)(-0.5) + 0(-0.5) + 1(-0.5) + 2(-0.5) + (-2)(0.5) + (-1)(0.5) + 0(0.5) + 1(0.5) + 2(0.5))/9 = 0/9 = 0
Cov = [2.2  0
       0   0.28]
Step 4: Find the eigenvalues
λ1 = 2.2
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v1 = [1
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v1 = [1
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v2 = [0
      1]
Step 7: Find the principal components
PC1 = [1
       0]
PC2 = [0
       1]
```

Question 4:

Consider the following two-dimensional data set: $\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

```
Step 1: Find the mean vector
μ = (x̄1, x̄2) = (3, 1.5)
Step 2: Subtract the mean
B = {(-2,-0.5), (-1,-0.5), (0,-0.5), (1,-0.5), (2,-0.5), (-2,0.5), (-1,0.5), (0,0.5), (1,0.5), (2,0.5)}
Step 3: Calculate the covariance matrix
Cov(x1, x1) = ((-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2 + (-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2)/9 = 20/9 = 2.2
Cov(x2, x2) = ((-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2)/9 = 2.5/9 = 0.28
Cov(x1, x2) = ((-2)(-0.5) + (-1)(-0.5) + 0(-0.5) + 1(-0.5) + 2(-0.5) + (-2)(0.5) + (-1)(0.5) + 0(0.5) + 1(0.5) + 2(0.5))/9 = 0/9 = 0
Cov = [2.2  0
       0   0.28]
Step 4: Find the eigenvalues
λ1 = 2.2
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Step 5: Find the eigenvectors
v1 = [1
      0]
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      1]
Step 6: Normalize the eigenvectors
v1 = [1
      0]
v2 = [0
      1]
Step 7: Find the principal components
PC1 = [1
       0]
PC2 = [0
       1]
```

Question 5:

Consider the following two-dimensional data set: $\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

```
Step 1: Find the mean vector
μ = (x̄1, x̄2) = (3, 1.5)
Step 2: Subtract the mean
B = {(-2,-0.5), (-1,-0.5), (0,-0.5), (1,-0.5), (2,-0.5), (-2,0.5), (-1,0.5), (0,0.5), (1,0.5), (2,0.5)}
Step 3: Calculate the covariance matrix
Cov(x1, x1) = ((-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2 + (-2)^2 + (-1)^2 + 0^2 + 1^2 + 2^2)/9 = 20/9 = 2.2
Cov(x2, x2) = ((-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (-0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2 + (0.5)^2)/9 = 2.5/9 = 0.28
Cov(x1, x2) = ((-2)(-0.5) + (-1)(-0.5) + 0(-0.5) + 1(-0.5) + 2(-0.5) + (-2)(0.5) + (-1)(0.5) + 0(0.5) + 1(0.5) + 2(0.5))/9 = 0/9 = 0
Cov = [2.2  0
       0   0.28]
Step 4: Find the eigenvalues
λ1 = 2.2
λ2 = 0.28
Step 5: Find the eigenvectors
v1 = [1
      0]
v2 = [0
      1]
Step 6: Normalize the eigenvectors
v1 = [1
      0]
v2 = [0
      1]
Step 7: Find the principal components
PC1 = [1
       0]
PC2 = [0
       1]
```

Assignment 4 part 2 of 2:

Question 1:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 2:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 3:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 4:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 5:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 6:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 7:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 8:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 9:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Question 10:

Consider the following two-dimensional data set:

$\{(1,1), (2,1), (3,1), (4,1), (5,1), (1,2), (2,2), (3,2), (4,2), (5,2)\}$

Compute the principal components in this data set.

Assignment 5:

Question 1:

Consider the following network:

Question 2:

Consider the following network:

Question 3:

Consider the following network:

Question 4:

Consider the following network:

Question 5:

Consider the following network:

Step 1: Find the adjacency matrix
A = [0 1 1 1 0
     1 0 1 1 1
     1 1 0 1 1
     1 1 1 0 1
     0