Feedback — Week4B (Basic)

Help Center

You submitted this quiz on **Fri 27 Feb 2015 7:33 PM PST**. You got a score of **4.00** out of **4.00**.

Question 1

Note: In this question, all columns will be written in their transposed form, as rows, to make the typography simpler. Matrix M has three rows and two columns, and the columns form an orthonormal basis. One of the columns is [2/7,3/7,6/7]. There are many options for the second column [x,y,z]. Write down those constraints on x, y, and z. Then, identi fy in the list below the one column that could be [x,y,z]. All components are computed to three decimal places, so the constraints may be satisfied only to a close approximation.

Your Answer		Score	Explanation
[-.548, .401, .273]			
[.608, -.459, -.119]			
[.702, -.702, .117]	✔	1.00	
[.312, .156, -.937]			
Total		1.00 / 1.00	

Question Explanation

The dot product of [2/7,3/7,6/7] and [x,y,z] must be 0, so 2x+3y+6z=0. Also, the length of the vector [x,y,z] must be 1, so $x^2+y^2+z^2 = 1$. Any vector satisfying these two constraints is a possible answer.

Question 2

Note: In this question, all columns will be written in their transposed form, as rows, to make the typography simpler. Matrix M has three rows and three columns, and the columns form an orthonormal basis. One of the columns is [2/7,3/7,6/7], and another is [6/7, 2/7, -3/7]. Let the third column be [x,y,z]. Since the length of the vector [x,y,z] must be 1, there is a constraint that $x^2+y^2+z^2 = 1$. However, there are other constraints, and these other constraints can be used to deduce facts about the ratios among x, y, and z. Compute these ratios, and then identify one of them in the list below.

Your Answer		Score	Explanation
y = 3z			
2x = 3z	✔	1.00	
x = 2y			
y = 2x			
Total		1.00 / 1.00	

Question Explanation

The dot product of [x,y,z] with each of the two other columns must be 0. Thus, 2x+3y+6z=0 and 6x+2y-3z=0. Add the first equation to twice the second and obtain 14x+7y=0. From this equation, we deduce y = -2x. If we make this substitution for y, the first equation becomes -4x+6z=0, or 2x = 3z. Combining these two ratios, we find y = -3z.

Question 3

Suppose we have three points in a two dimensional space: (1,1), (2,2), and (3,4). We want to perform PCA on these points, so we construct a 2-by-2 matrix whose eigenvectors are the directions that best represent these three points. Construct this matrix and identify, in the list below, one of its elements.

Your Answer		Score	Explanation
22			
21	✔	1.00	
19			
16			
Total		1.00 / 1.00	

Question Explanation

Construct the matrix M whose columns correspond to the dimensions of the space and whose rows correspond to the points. That is, M =

1	1
2	2

3	4

. Compute M^TM, which is

14	17
17	21

. This is the matrix whose eigenvectors are the principal components. Thus, the correct answers are 14, 17, and 21.

Question 4

Find, in the list below, the vector that is orthogonal to the vector [1,2,3]. Note: the interesting concept regarding eigenvectors is "orthonormal," that is unit vectors that are orthogonal. However, this question avoids using unit vectors to make the calculations simpler.

Your Answer		Score	Explanation
○ [-1, 1, -1]			
◉ [-1, -1, 1]	✔	1.00	
○ [1, 1/2, 1/3]			
○ [-1, -2, -3]			
Total		1.00 / 1.00	

Question Explanation

Vectors are orthogonal if and only if their dot product (sum of the products of their corresponding components) is 0. For example, one of the correct choices is [-4, -1, 2] The dot product of this vector with [1,2,3] is 1*(-4) + 2*(-1) + 3*2 = -4 + -2 + 6 = 0.