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Qec of orthogonalization:

we have matrix A with column, a, b, c

$$A = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 0 & 5 \\ 0 & 3 & 6 \end{bmatrix}$$

and we need to find orthogonal vectors
 q_1, q_2, q_3 from the above 3 columns

i.e. a, b, c [columns of A]

Then write A as QR (Decomposition)

where Q is orthogonal matrix

and R is upper triangular

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Rem: orthogonal matrix, is a matrix
whose columns are orthonormal vectors.

GS:
Consist of the following:
At each step you find your
orthogonal vector (q_1, q_2, q_3)
by taking the vector that you start
with (a, b, c) and making it
orthonormal. to previous ones (q_1, q_2)

∴ Find q_1 : Start with a , and make it
orthonormal to the previous ones.
here is no previous ones, so
that is very easy
⇒ direction of a is fine, so
you just need to ensure that
vector has length one (1)

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$\therefore q_1$

$\therefore a$ is vector $(1, 0, 0)$

$$\therefore q_1 = \frac{a}{1} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$q_2 \perp b$

to get q_2 : will start with vector b , then make it orthogonal to what I already have, which is q_1 for that I am going to subtract off from b , the projection of b onto q_1 .

$$q_2 = b - (b \cdot q_1) q_1$$

usually when you do the projection of vector onto another vector, you have to divide it by length of b in this case q_1 , but because q_1

has length 1, you don't need to do that. (4)

So what will it be here:

$$q_2 = b - (b \cdot q_1) q_1$$
$$\therefore = \begin{bmatrix} 2 \\ 0 \\ 3 \end{bmatrix} - 2 \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 3 \end{bmatrix}$$

① q_2 the vector orthogonal to $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = q_1$

How do we check, by doing the dot product.

① But we need this vector also to

have a length 1.

→ Because we want these vectors to be orthonormal.

$$q_2 = \frac{q_2}{3(\text{length})} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

⑤ $q_3 = c$ I start with my 3rd vector, c ,

then I want to subtract the projection of c onto q_1 and q_2 , and that will give me a q_3 that's orthogonal to both q_1 and q_2 .

$$q_3 = c - (C \cdot q_1)q_1 - (C \cdot q_2)q_2 \quad \textcircled{B}$$
$$= \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} - \overset{(q_1)}{4} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} - \overset{(q_2)}{6} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 5 \\ 0 \end{bmatrix} \overset{q_3'}{q_3}$$

⑤ vector is orthogonal to q_1 and q_2 ,
But it's not orthonormal yet.

$$\therefore q_3 = \frac{q_3'}{5} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

Note: my vectors q_1, q_2, q_3 are very nice,

Usually when you perform GS orthogonalization,
you end up with lots of square roots

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Since you dividing by the length.

In the case
In our case we have everything as integers,
which is very lucky.

Next: we want to write the QR decomposition of
the matrix A.

$$A = QR$$

$$\begin{bmatrix} 1 & 2 & 4 \\ 0 & 0 & 5 \\ 0 & 3 & 6 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 & 4 \\ 0 & 3 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

In Q, you want an
orthogonal matrix
such matrix have
orthonormal vectors
as its columns
But we already
have such a matrix

So how do we get R?

Let's look at matrix Q;

it is simply a permutation
matrix

— roots very easy to come up with matrix for Q

What the permutation (Q) does:
it exchanges row 2 and 3 of my matrix
R, to give you A.
we then knew what R must be.

Then we need an
upper triangular matrix
that makes the
equality true

∴ indeed R is upper triangular.

But let's see where these numbers in matrix R is coming from.

$$\begin{matrix} & \begin{matrix} A & Q & R \end{matrix} \\ \begin{bmatrix} 1 & 2 & 4 \\ 0 & 0 & 5 \\ 0 & 3 & 4 \end{bmatrix} & = & \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} & \begin{bmatrix} 1 & 2 & 4 \\ 0 & 3 & 6 \\ 0 & 0 & 5 \end{bmatrix} \\ \begin{matrix} a & b & c \end{matrix} & & \begin{matrix} q_1 & q_2 & q_3 \end{matrix} & \begin{matrix} r_{11} & r_{12} & r_{13} \\ & r_{22} & r_{23} \\ & & r_{33} \end{matrix} \end{matrix}$$

You know from the way matrix multiplication works.

That $a = Q \text{ times First Column}(R)$

$$\text{(First Column)} \quad a = 1q_1 + 0q_2 + 0q_3$$

$$\text{(2nd Column)} \quad b = 2q_1 + 3q_2 + 0q_3$$

$$c = 4q_1 + 6q_2 + 5q_3$$

Let's see where the number is showing up. (8)

$$\therefore q_1 = \frac{a}{1} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \quad a = 1q_1$$

$$3q_2 = q_2 = b - (b^2 q_1) q_1$$

$$q_3 = \frac{q_3}{5} \quad [q_3 = 5q_3]$$

$$5q_3' q_3' = C = (C \cdot q_1 q_1) - (C \cdot q_2 q_2)$$

Payment and Credit Policy

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New customers are required to submit a copy of proof of company registration. This can be OK cards from CMAA, CMAA 2 or a founding statement for a CO. As long as the company registration number reflects on a and it matches the registration number and the director signing the COA.

Prepaid accounts have a default monthly credit limit of \$200 per month. This may be increased, however, for any amount above \$200 we reserve the right to complete a credit application and account assessment.

1. If the company bank code results are an A or B you may have your credit limit increased to the requested amount.
2. If the company bank code is returned as a C you may have your credit limit increased up to \$500 to the requested amount once a month. The requested amount must be on the requested amount. For amounts over \$500 a credit application must be submitted and a director sign limited personal survey for the amount or switch to prepaid.
3. If the company bank code is returned as a D you may have your credit limit increased up to \$1000 to the requested amount once a month. The requested amount must be on the requested amount. For amounts over \$1000 a credit application must be submitted and a director sign limited personal survey for the amount or switch to prepaid.

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If you renew your services or online with your online TMS account as if you were a card, the updates are instant. However, if you wish to pay by EFT, it will only be applied during working hours Monday to Friday 9am to 5pm.

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