

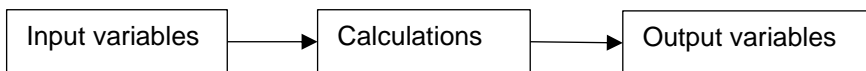


Guidance for doing calculations

How to prepare for examination questions that involve the use of algorithms

I use the term 'running an algorithm' to mean doing a set of calculations.

Algorithm



What do you need to know to run an algorithm in an examination?

1. You need to understand the meanings of all variables to an extent that you are able to assign correct values to them.
2. You need to be able to write down the steps in the algorithm.
3. You need to be able to run the algorithm.

For example, here is a 'run' of the algorithm for solving for the forces at Joint B in the [Nodal Analysis key example](#):

Isolate joint B

Apply vertical equilibrium: $\Sigma F_y = 0$

$$9 \cdot \sin(30) + F_{BD} \cdot \sin(30) - 3 - F_{BC} \cdot \sin(30) = 0$$

Substitute for $\sin(30) = 0.5$:

$$9 \cdot 0.5 + F_{BD} \cdot 0.5 - 3 - F_{BC} \cdot 0.5 = 0$$

$$1.5 + F_{BD} \cdot 0.5 - F_{BC} \cdot 0.5 = 0$$

Rearrange to find an expression for F_{BD} :

$$F_{BD} \cdot 0.5 = -1.5 + F_{BC} \cdot 0.5$$

$$F_{BD} = -3 + F_{BC}$$

Apply horizontal equilibrium: $\Sigma F_x = 0$

$$9 \cdot \cos(30) + F_{BD} \cdot \cos(30) + F_{BC} \cdot \cos(30) = 0$$

Divide each term by $\cos(30)$:

$$9 + F_{BD} + F_{BC} = 0$$

Substitute $F_{BD} = -3 + F_{BC}$:

$$9 + (-3 + F_{BC}) + F_{BC} = 0$$

$$6 + 2F_{BC} = 0$$

$$F_{BC} = -3 \text{ kN (compression)}$$

Solve for F_{BD} :

$$F_{BD} = -3 + F_{BC}$$

$$F_{BD} = -3 - 3 = -6 \text{ kN (compression)}$$

The steps in the algorithm are:

1. Draw the free body diagram for the joint. The input variables are:
 - The 9 kN force in member AB that has been previously calculated
 - The 3 kN load on the joint
 - The geometry of the joint in terms of the angles between the members

The output variables are: F_{BD} and F_{BC}

2. Resolve the forces into the x and y directions.
3. Write the equation of equilibrium for the x or the y direction.
4. Use the rules of algebra to find an expression for one of the output variables (A) in terms of the other output variable (B).
5. Write the equation of equilibrium for the other direction.
6. Substitute the expression for variable A and solve for the value of variable B
7. Back-substitute to get the value of variable A.

How do you practise so as to be able to do that?

I could start by working with examples, exercises, definitions and explanations until you have an understanding of the process. Practise using the algorithm. Keep asking questions such as 'What does that mean?' 'How do I do that?'

Then work on your memory. Memory should follow understanding.

Write down the variables and make sure that you know how to assign values to them

Write out the algorithm. Make sure that you can do that from memory.

Do not leave anything to the last minute. Few people can cram for understanding; both memorising facts and developing understanding need repetition.

That is the process that I used as a student. It got me good marks.

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