# PROGRAM DESIGN

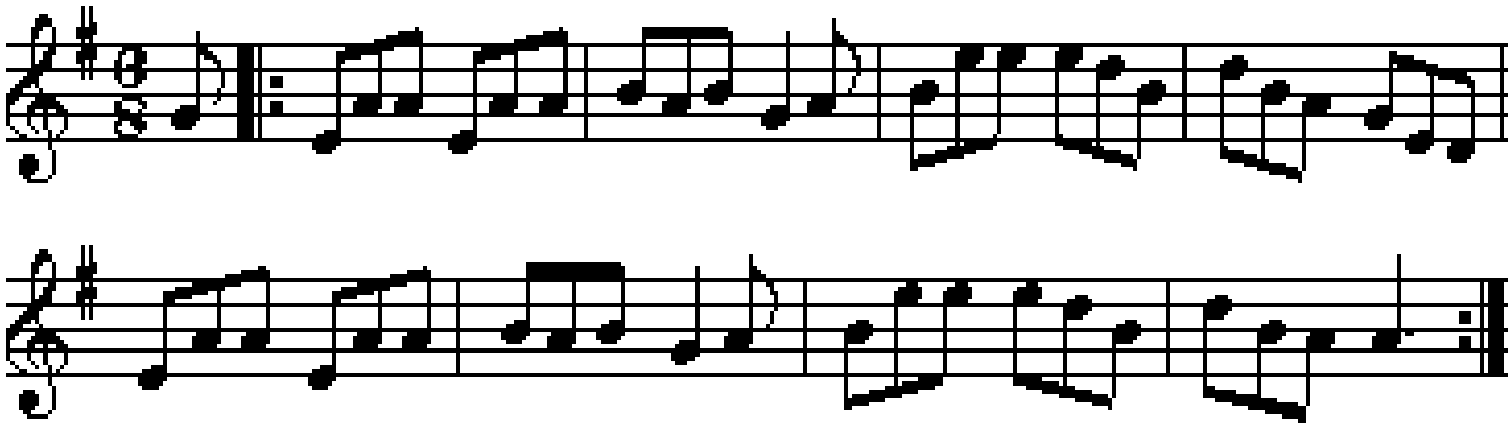
# **TUTORIAL 1**

# What is an Algorithm?

- An algorithm is a well-developed, organized approach to solving a complex problem.

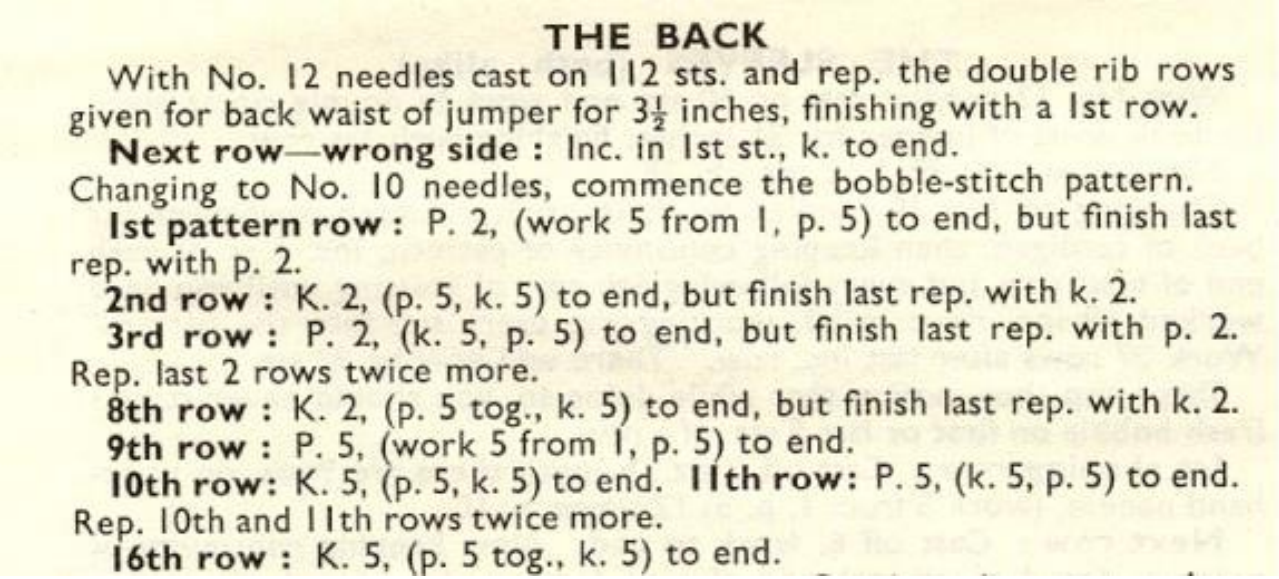
# Algorithms

- Examples of algorithms include
  - Musical scores



# Algorithms

- Examples of algorithms include
  - Knitting patterns



**THE BACK**

With No. 12 needles cast on 112 sts. and rep. the double rib rows given for back waist of jumper for 3½ inches, finishing with a 1st row.

**Next row—wrong side :** Inc. in 1st st., k. to end.

Changing to No. 10 needles, commence the bobble-stitch pattern.

**1st pattern row :** P. 2, (work 5 from 1, p. 5) to end, but finish last rep. with p. 2.

**2nd row :** K. 2, (p. 5, k. 5) to end, but finish last rep. with k. 2.

**3rd row :** P. 2, (k. 5, p. 5) to end, but finish last rep. with p. 2.

Rep. last 2 rows twice more.

**8th row :** K. 2, (p. 5 tog., k. 5) to end, but finish last rep. with k. 2.

**9th row :** P. 5, (work 5 from 1, p. 5) to end.

**10th row:** K. 5, (p. 5, k. 5) to end. **11th row:** P. 5, (k. 5, p. 5) to end.

Rep. 10th and 11th rows twice more.

**16th row :** K. 5, (p. 5 tog., k. 5) to end.

# Algorithms

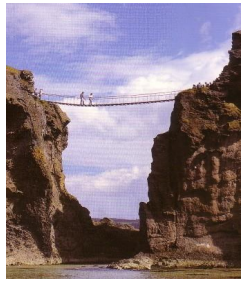
- Examples of algorithms include
  - Recipes

Warm Potato & Green Bean Salad

12-14 small new potatoes
1 c. green beans halved
1/2 sm. red onion, slivered
1/2 red pepper, chopped
1 garlic clove, grated
3 T. olive oil
2 T. red wine vinegar
1/2 t. salt
1/8 t. black pepper
2 t. fresh parsley, chopped
1/8 t. each basil, oregano & thyme

Cook unpeeled potatoes covered in water until tender, about 15 minutes, adding green beans to pan for last 5 minutes to barely cook. Drain and place in salad bowl. Add onion and pepper to bowl. Mix remaining dressing ingredients and pour over potato mix tossing gently to coat. Let sit at room temperature about 1 hour before serving. Serves 4.

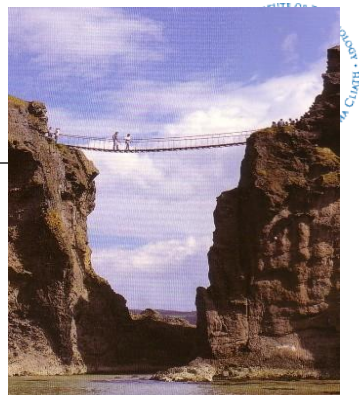
# Algorithms



- The ‘Crossing’ problem solutions are examples of algorithms that are represented pictorially rather than as a set of instructions

| Elapsed Time | Starting Side | Action | Ending Side |
|---|---|---|---|
| 0 minutes | A B C D | | |
| 2 minutes | C D | A and B cross forward, taking 2 minutes | A B |
| 3 minutes | A C D | A returns, taking 1 minute | B |
| 8 minutes | D | A and C cross forward, taking 5 minutes | A B C |
| 9 minutes | A D | A returns, taking 1 minute | B C |
| 17 minutes | | A and D cross forward, taking 8 minutes | A B C D |

# EXAMPLE: Four Men Crossing a Bridge



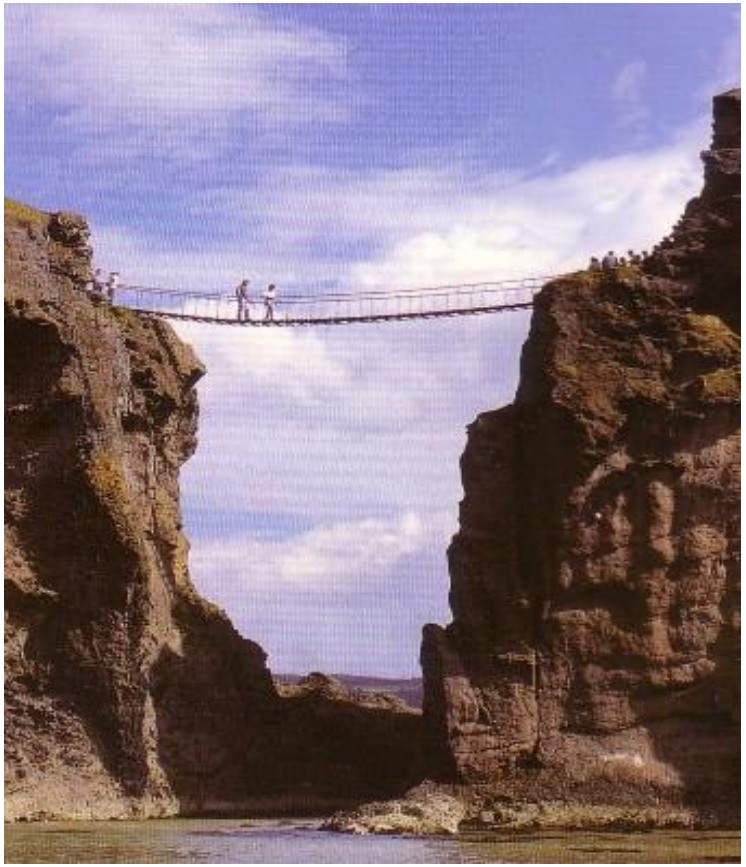
This is an example of the type of problem you are looking for:

**There are four men who would all like to cross a rickety old rope bridge.**

**The old bridge will only support 2 men at a time, and it is night time, so every crossing must use the one flashlight that they all share.**

**The four men each have different walking speeds; the fastest each of them can cross is**

- **A: 1 minute,**
- **B: 2 minutes,**
- **C: 5 minutes, and**
- **D: 8 minutes.**



# Exercise 1

For **Four Men Crossing a Bridge problem,** can you develop a strategy that permits a crossing in 15 minutes?

**Hint:** To find the correct solution, one must realize that forcing the two slowest people to cross individually wastes time which can be saved if they both cross together.

# Exercise 2

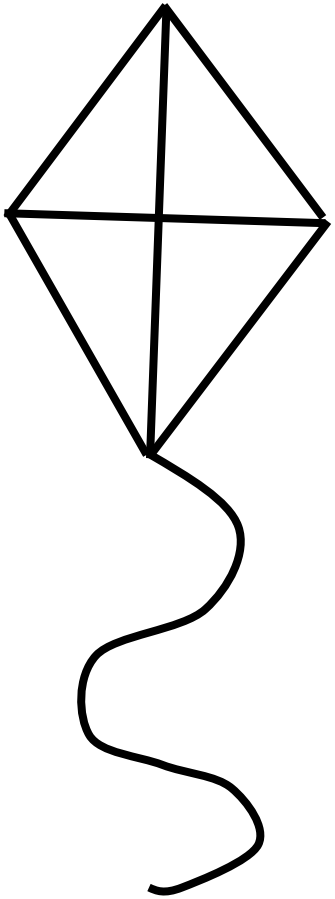
## Follow the following algorithm *exactly!!*

1. Draw a diagonal line
2. Draw another diagonal line connected to the top of the first one
3. Draw a straight line from the point where the diagonal lines meet
4. Draw a horizontal line over the straight line
5. At the bottom of the straight line, draw a curvy line
6. Draw a diagonal line from the bottom of the first diagonal to the straight line
7. Draw a diagonal line from the bottom of the second diagonal to the straight line

# How did the pictures turn out?

- Compare your picture with others' pictures…
  - Were they different?
  - Why?
  - What was difficult about following the instructions?
  - What was missing from the instructions?

# It was meant to be a kite!!



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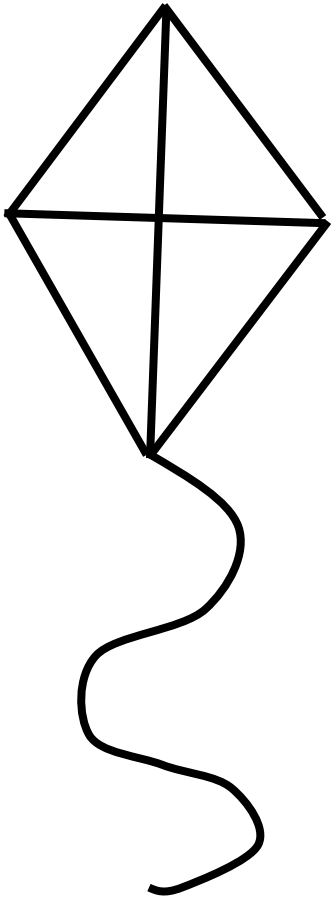
# Exercise 3:



- Now write a set of instructions that work!
- Ensure only *one* way to interpret each step
  - *unambiguous*
- … and enough detail in each step
- About 10 steps