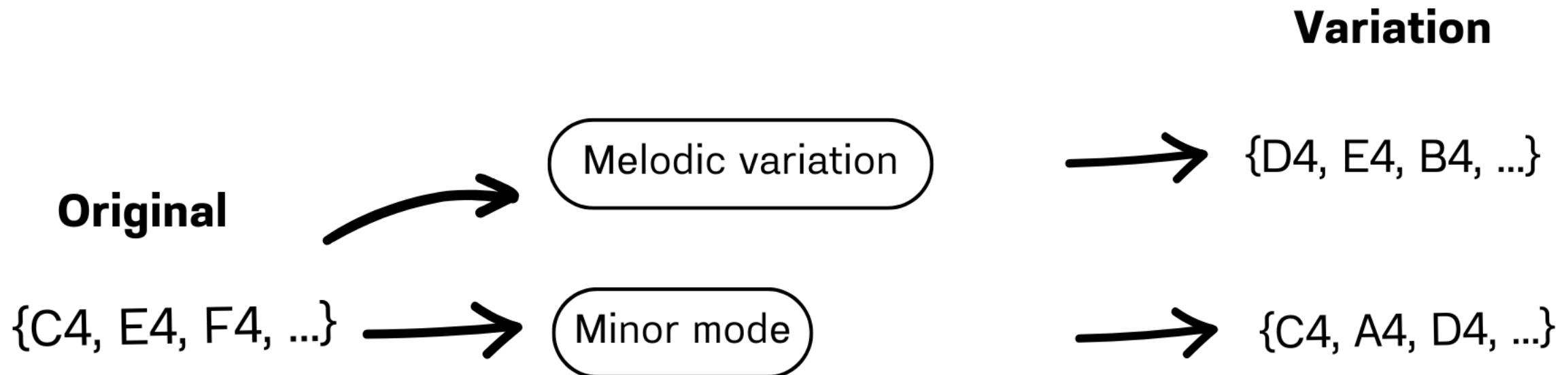


# A Chaos-Driven Approach to Augmenting and Enriching Symbolic Music Datasets

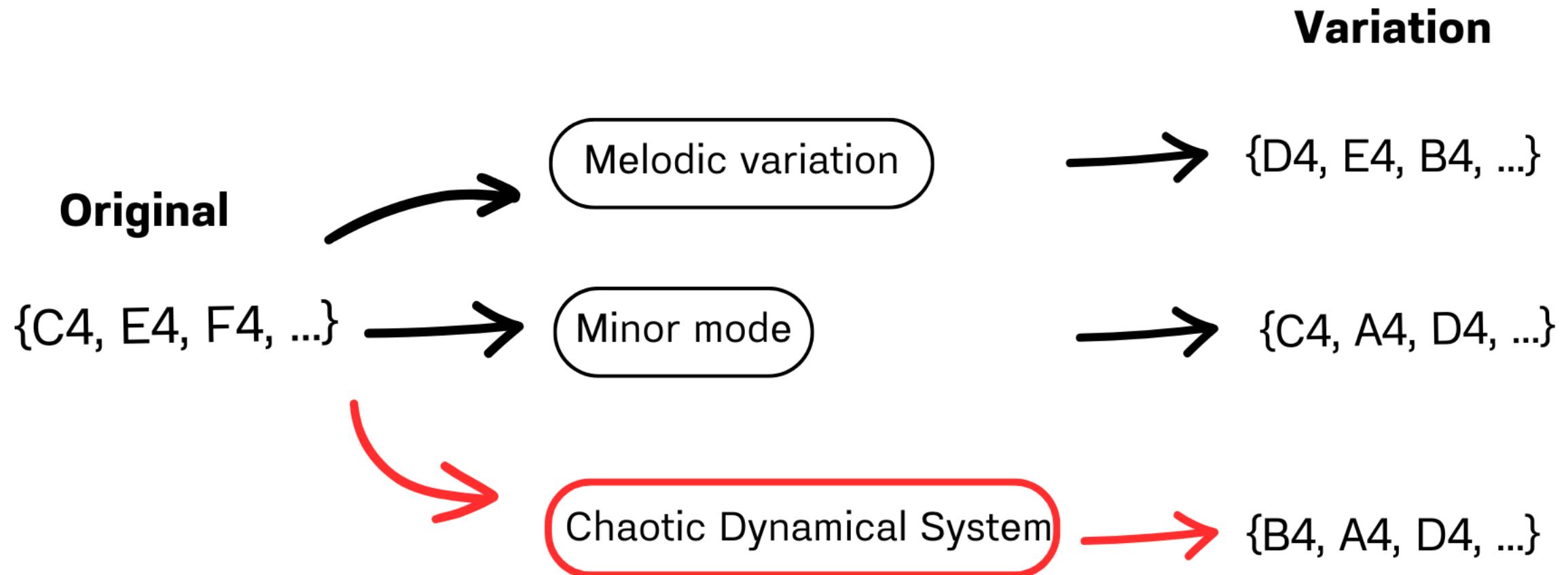
Kanatsanun Sub-udom  
Pichate Kunakornvong  
Ratthaprom Promkam

# Project Overview

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## Overview of Our Method

**Overview of Our Method**

# Overview of Our Method

$$\{p_k\}_{k=0}^4 = \{ C4, C4, G4, A4, F4 \}$$

## Overview of Our Method

$$\{p_k\}_{k=0}^4 = \{ C4 , \ C4 , \ G4 , \ A4 , \ F4 \}$$

$$\{\phi(kh)\}_{k=0}^4 = \{1.00 , \ 1.25 , \ 1.65 , \ 0.50 , \ 2.00\}$$

$$\boxed{\dot{x} = f(t, x), \ x(0) = x_0}$$

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$$\{\phi(kh)\}_{k=0}^4 = \{1.00, 1.25, 1.65, 0.50, 2.00\}$$

$$\alpha(\phi(kh)) = p_k$$

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$$\{\phi(kh)\}_{k=0}^4 = \{1.00, 1.25, 1.65, 0.50, 2.00\}$$

$$\{\tilde{\phi}(kh)\}_{k=0}^4 = \{1.10, 1.45, 0.75, 2.25, 0.25\}$$

$$\alpha(\phi(kh)) = p_k$$

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$$\{\phi(kh)\}_{k=0}^4 = \{1.00, 1.25, 1.65, 0.50, 2.00\}$$

$$\{\tilde{\phi}(kh)\}_{k=0}^4 = \{1.10, 1.45, 0.75, 2.25, 0.25\}$$

A diagram consisting of five vertical downward-pointing arrows. Each arrow connects an element in the middle row to an element in the bottom row. The first arrow connects the first element of the middle row to the first element of the bottom row. The second arrow connects the second element of the middle row to the second element of the bottom row. The third arrow connects the third element of the middle row to the third element of the bottom row. The fourth arrow connects the fourth element of the middle row to the fourth element of the bottom row. The fifth arrow connects the fifth element of the middle row to the fifth element of the bottom row.

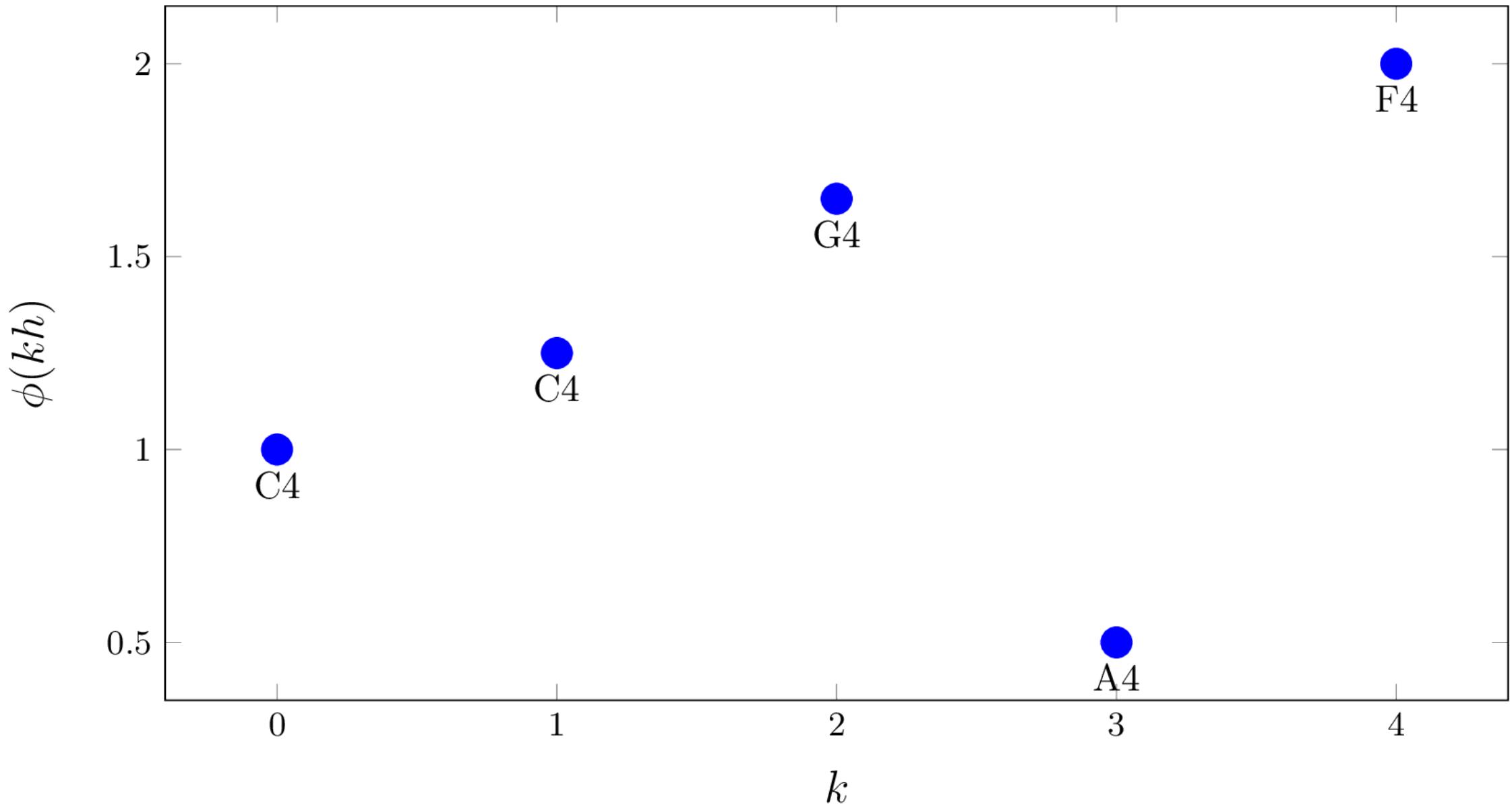
$$\{p'_k\}_{k=0}^4 = \{ ?, ?, ?, ?, ? \}$$

$$\alpha(\phi(kh)) = p_k$$

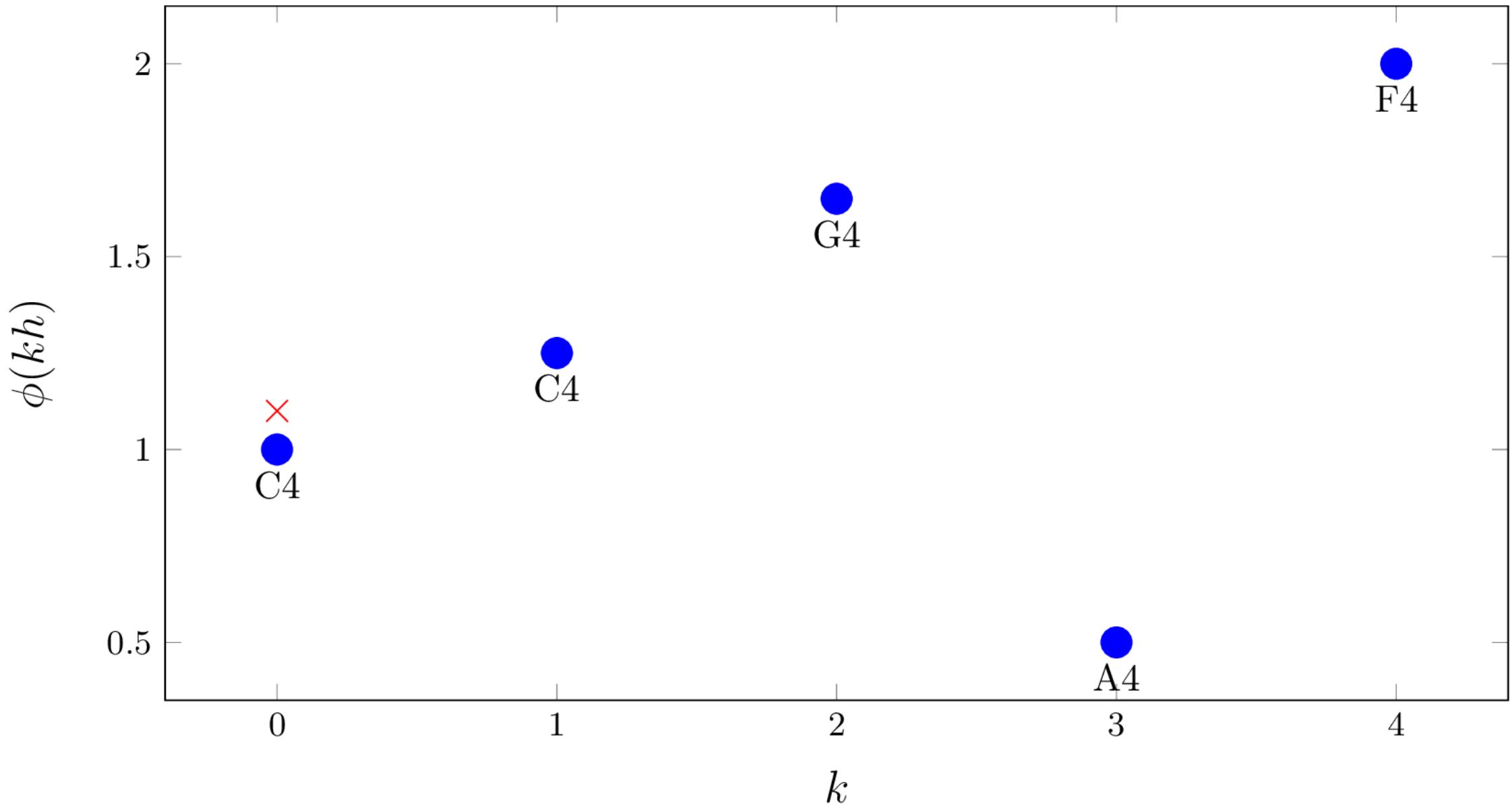
$$\dot{x} = f(t, x), x(0) = x_0$$

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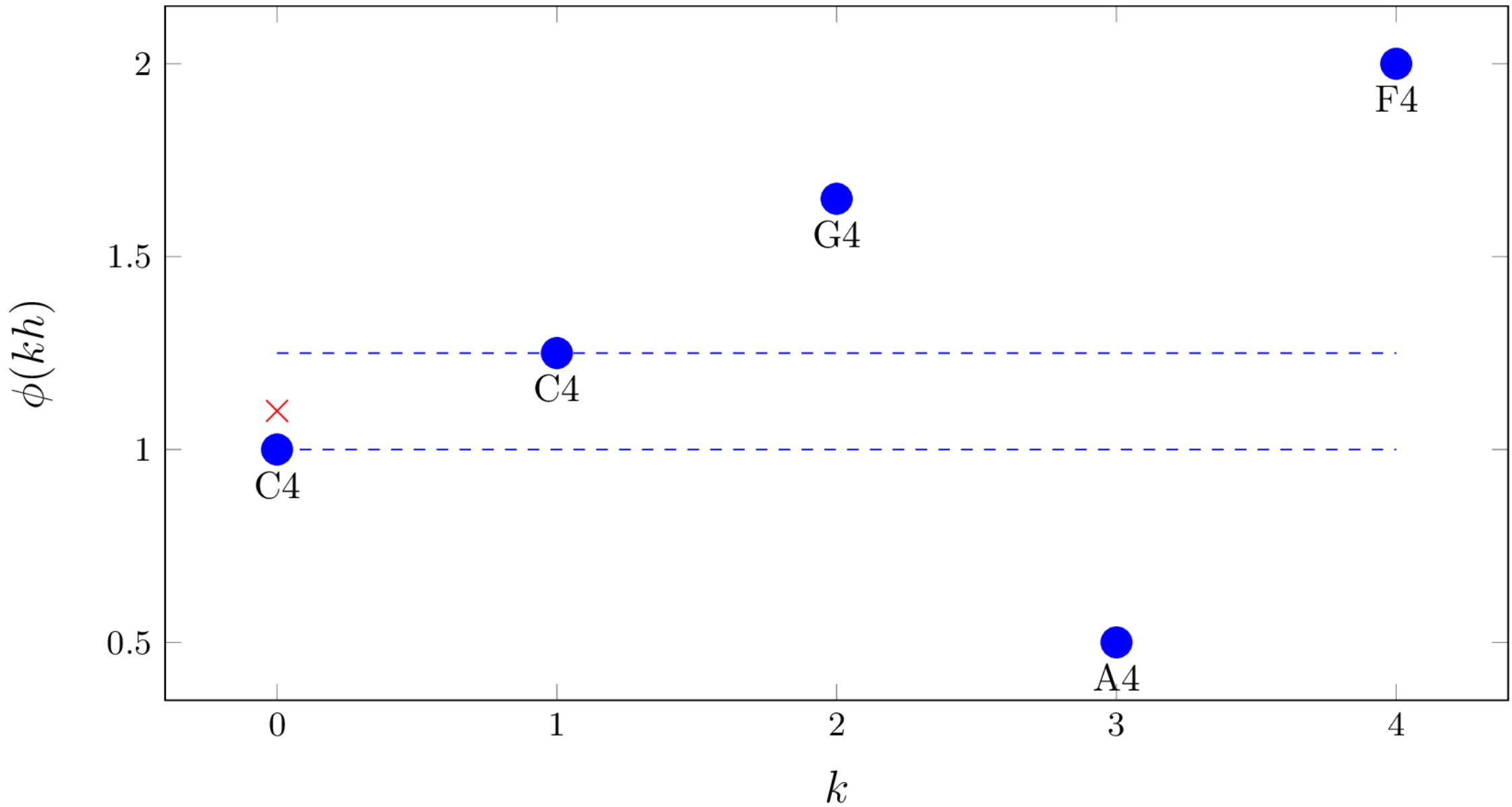
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$$\{p_k\}_{k=0}^4 = \{ C4, C4, G4, A4, F4 \}$$



$$\{\phi(kh)\}_{k=0}^4 = \{1.00, 1.25, 1.65, 0.50, 2.00\}$$

$$\{\tilde{\phi}(kh)\}_{k=0}^4 = \{1.10, 1.45, 0.75, 2.25, 0.25\}$$

Diagram illustrating the mapping between the sets  $\{\phi(kh)\}_{k=0}^4$  and  $\{p'_k\}_{k=0}^4$ . Five downward arrows connect the elements of the second row to the corresponding elements of the third row.

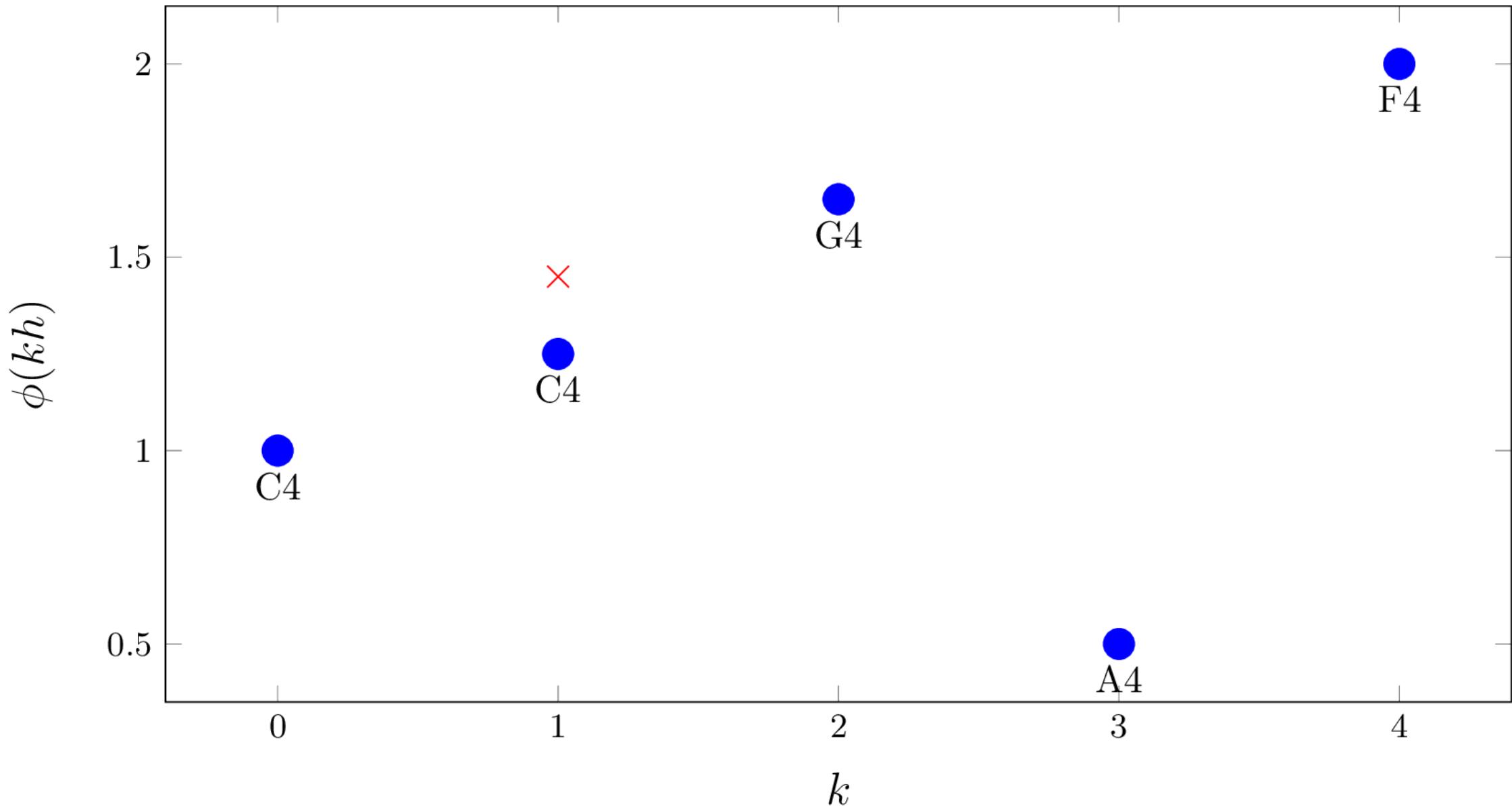
$$\{p'_k\}_{k=0}^4 = \{ C4, ?, ?, ?, ?, ? \}$$

$$\alpha(\phi(kh)) = p_k$$

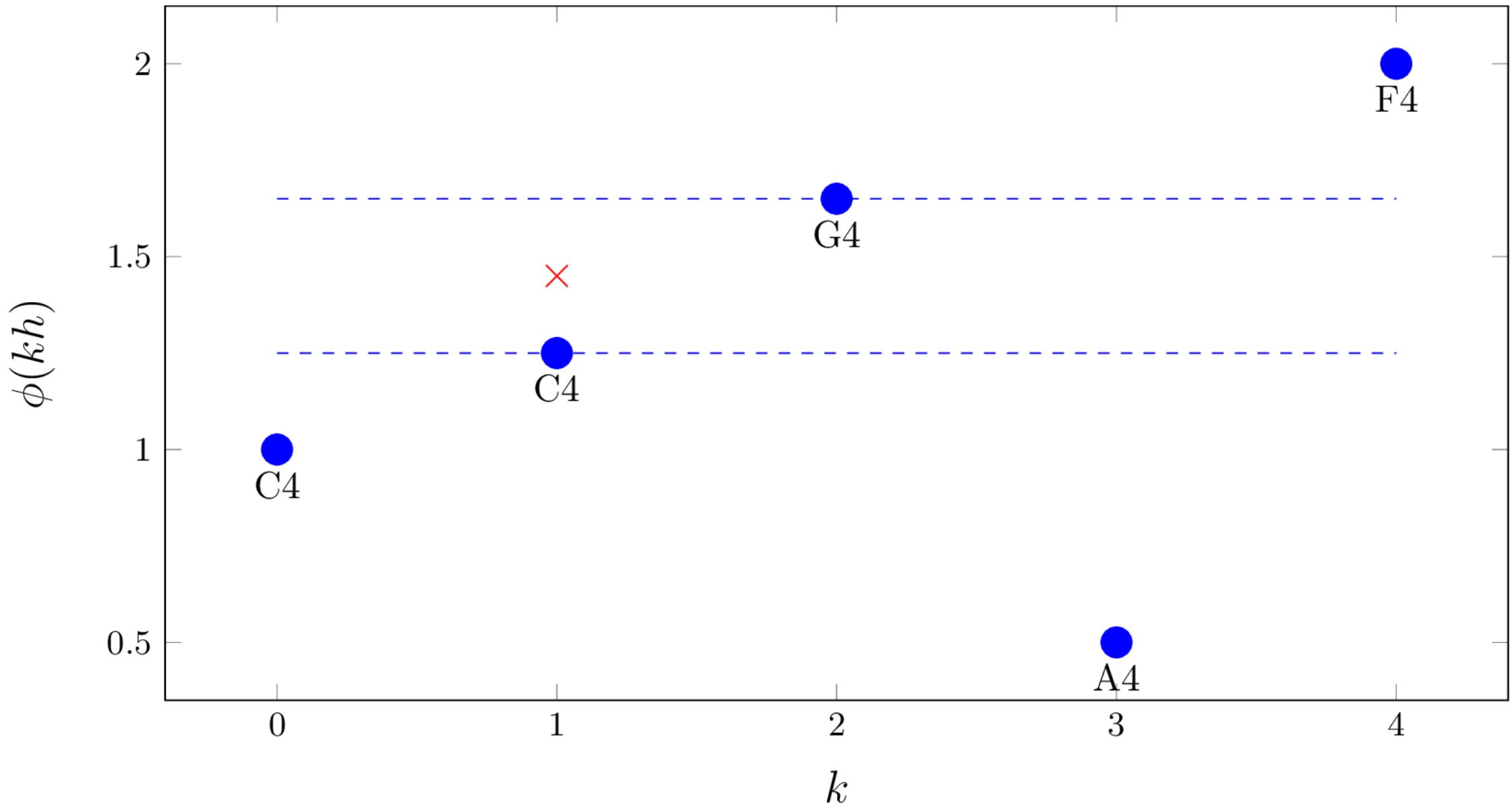
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$$\{p_k\}_{k=0}^4 = \{ C4, C4, G4, A4, F4 \}$$



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$$\alpha(\phi(kh)) = p_k$$

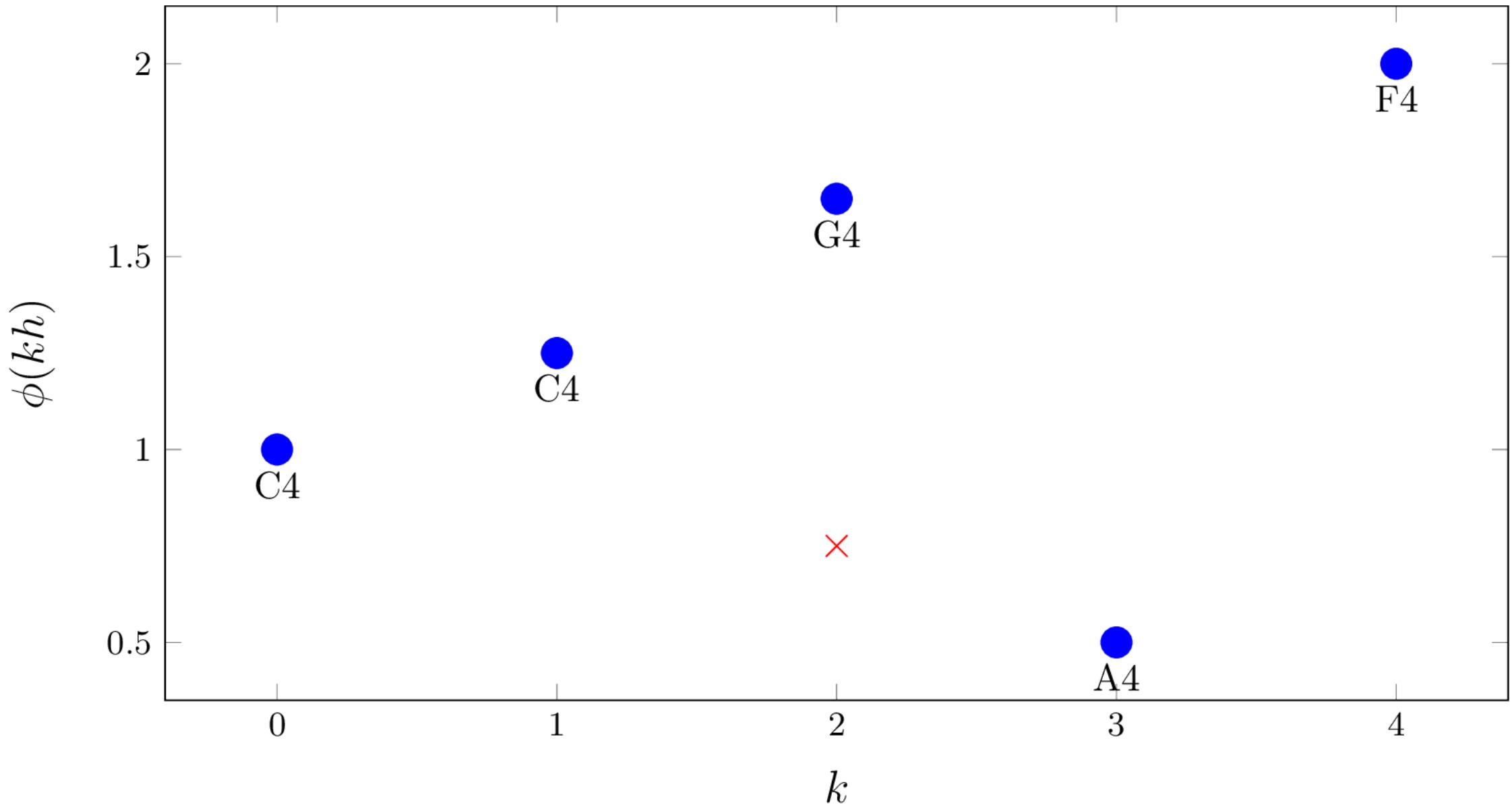
$$\{\tilde{\phi}(kh)\}_{k=0}^4 = \{1.10, 1.45, 0.75, 2.25, 0.25\}$$

$$\dot{x} = f(t, x), x(0) = x_0$$

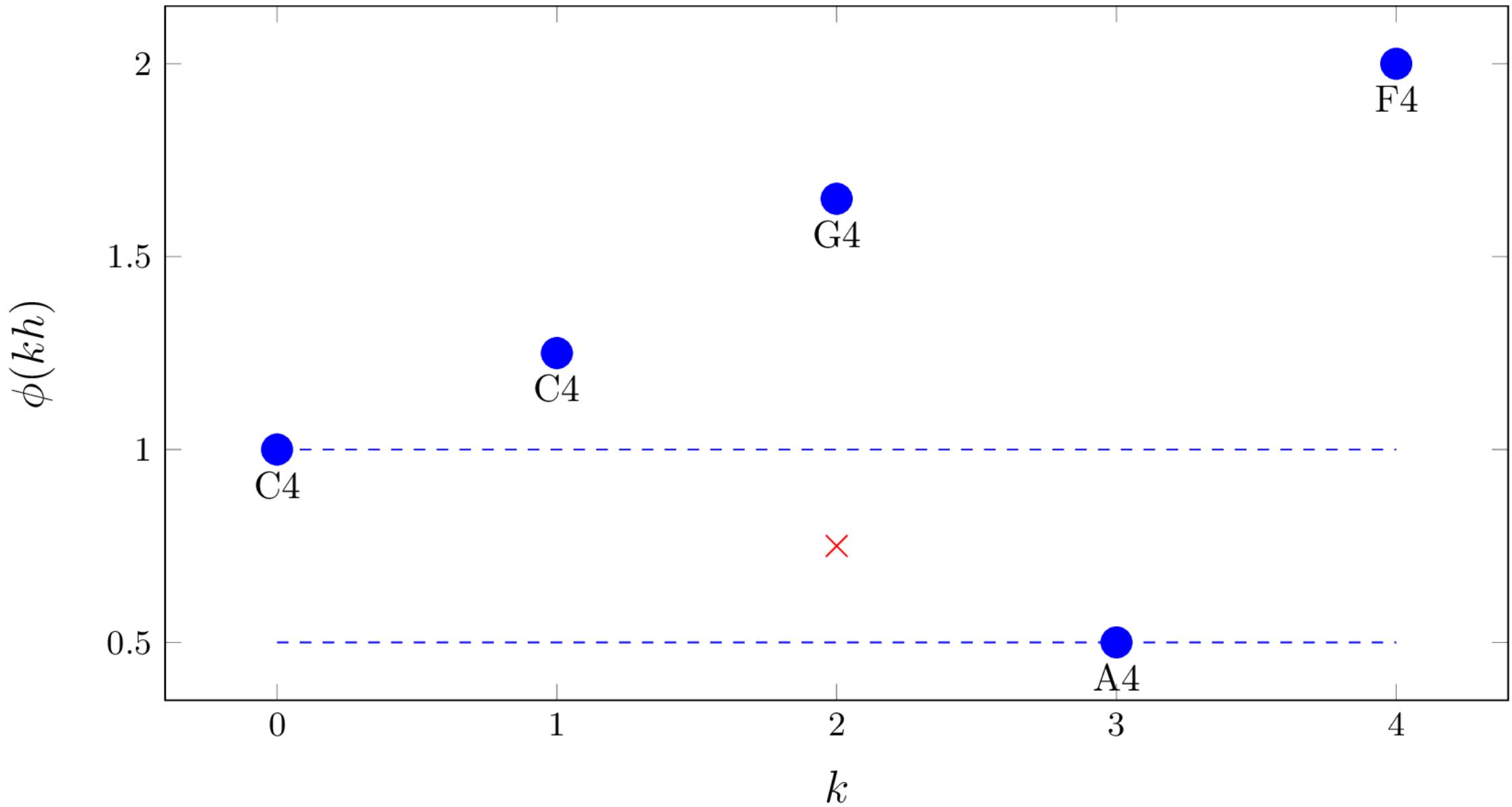
$$\{p'_k\}_{k=0}^4 = \{ C4, G4, ?, ?, ?, ? \}$$

$$\dot{x} = f(t, x), x(0) = \tilde{x}_0$$

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$$\{p_k\}_{k=0}^4 = \{ C4, C4, G4, A4, F4 \}$$



$$\{\phi(kh)\}_{k=0}^4 = \{1.00, 1.25, 1.65, 0.50, 2.00\}$$

$$\{\tilde{\phi}(kh)\}_{k=0}^4 = \{1.10, 1.45, 0.75, 2.25, 0.25\}$$

A diagram consisting of five vertical downward-pointing arrows. Each arrow connects the element at position  $k$  in the second row to the element at position  $k$  in the third row. The first arrow connects  $1.00$  to  $C4$ , the second to  $G4$ , the third to  $C4$ , the fourth to a question mark, and the fifth to another question mark.

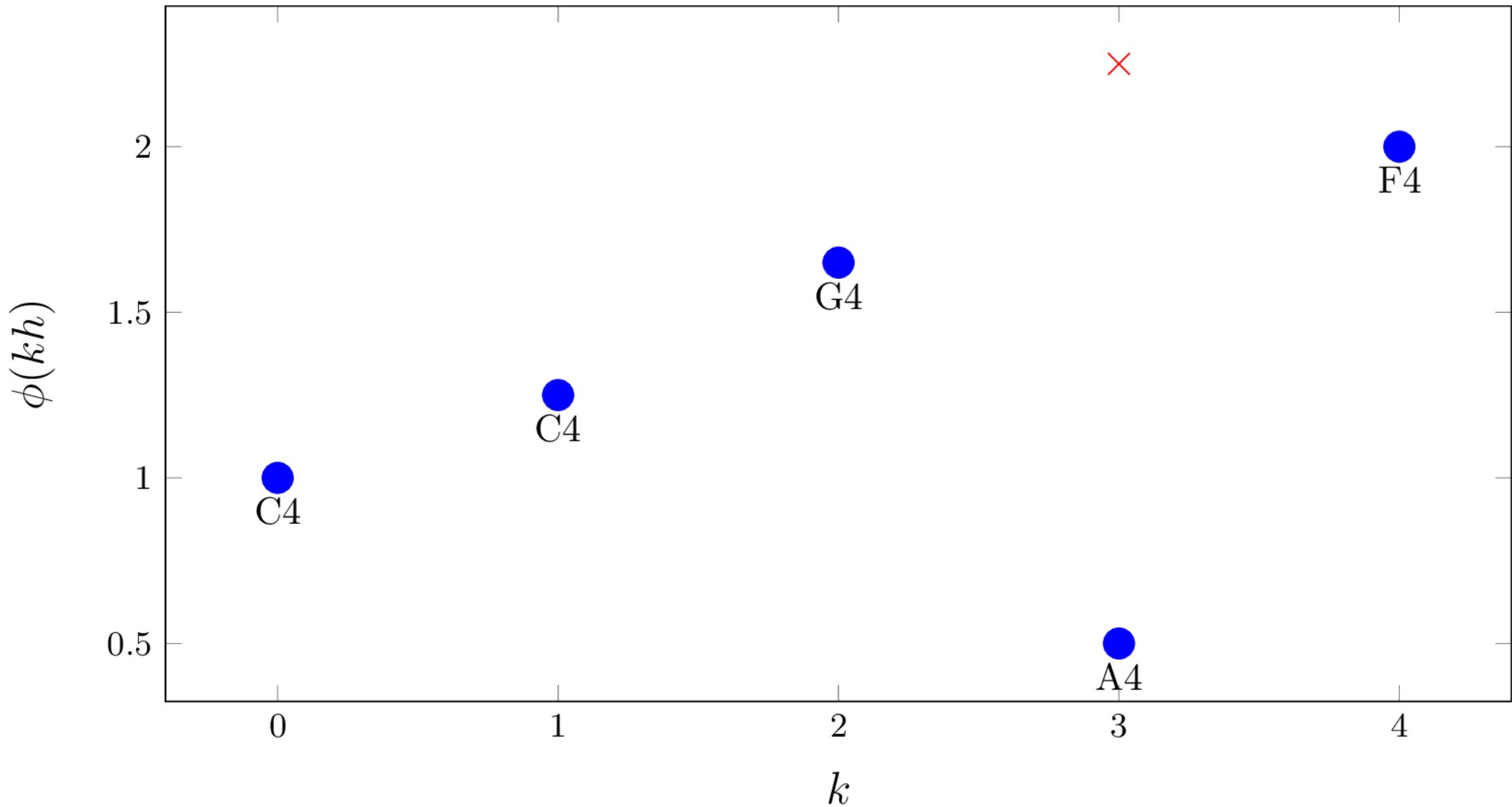
$$\{p'_k\}_{k=0}^4 = \{ C4, G4, C4, ?, ? \}$$

$$\alpha(\phi(kh)) = p_k$$

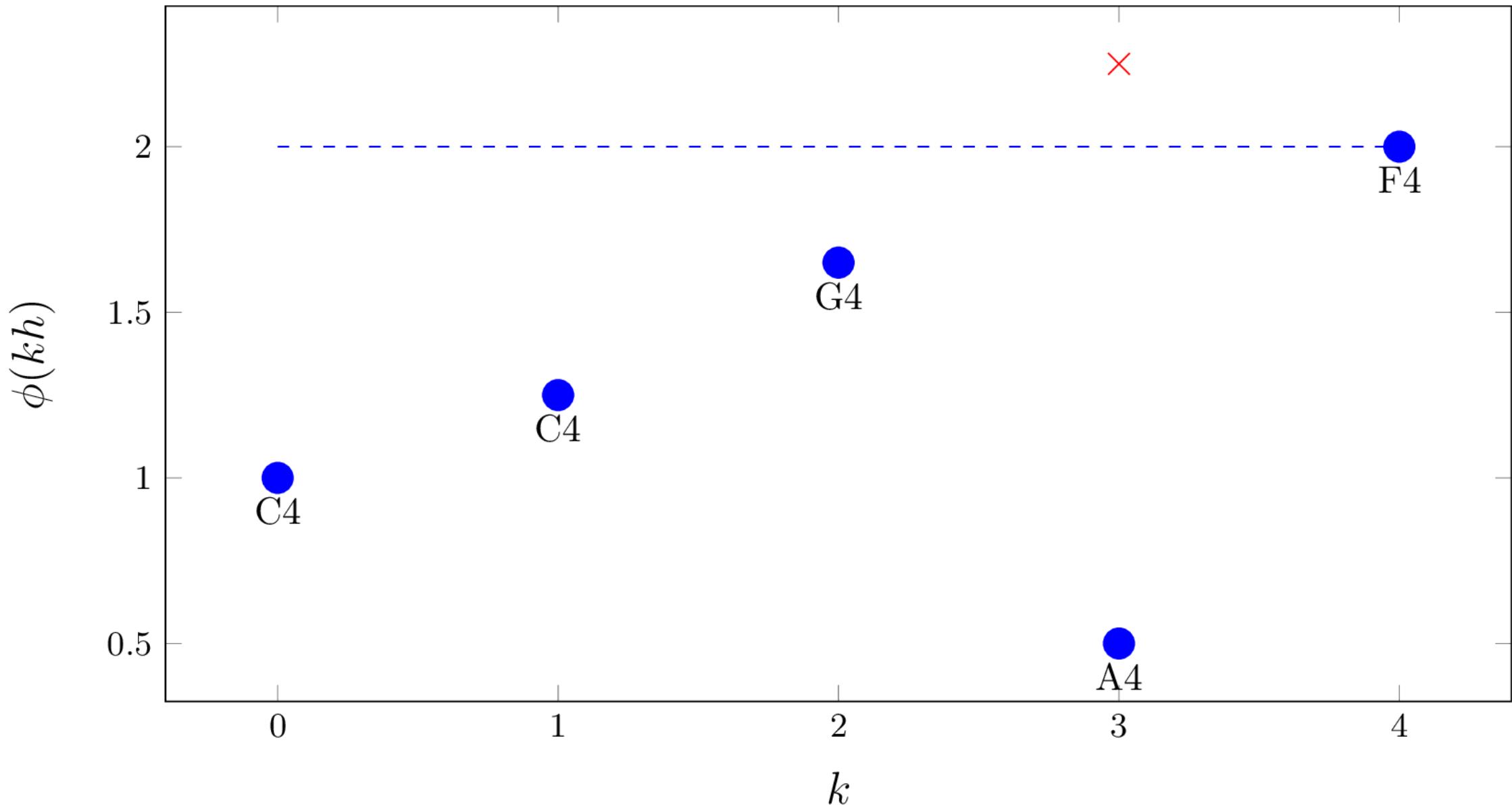
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A diagram consisting of five vertical downward-pointing arrows. Each arrow connects the element at position  $k$  in the second row to the element at position  $k$  in the third row. The first arrow connects  $1.00$  to  $C4$ , the second to  $G4$ , the third to  $C4$ , the fourth to  $F4$ , and the fifth to a question mark  $?$ .

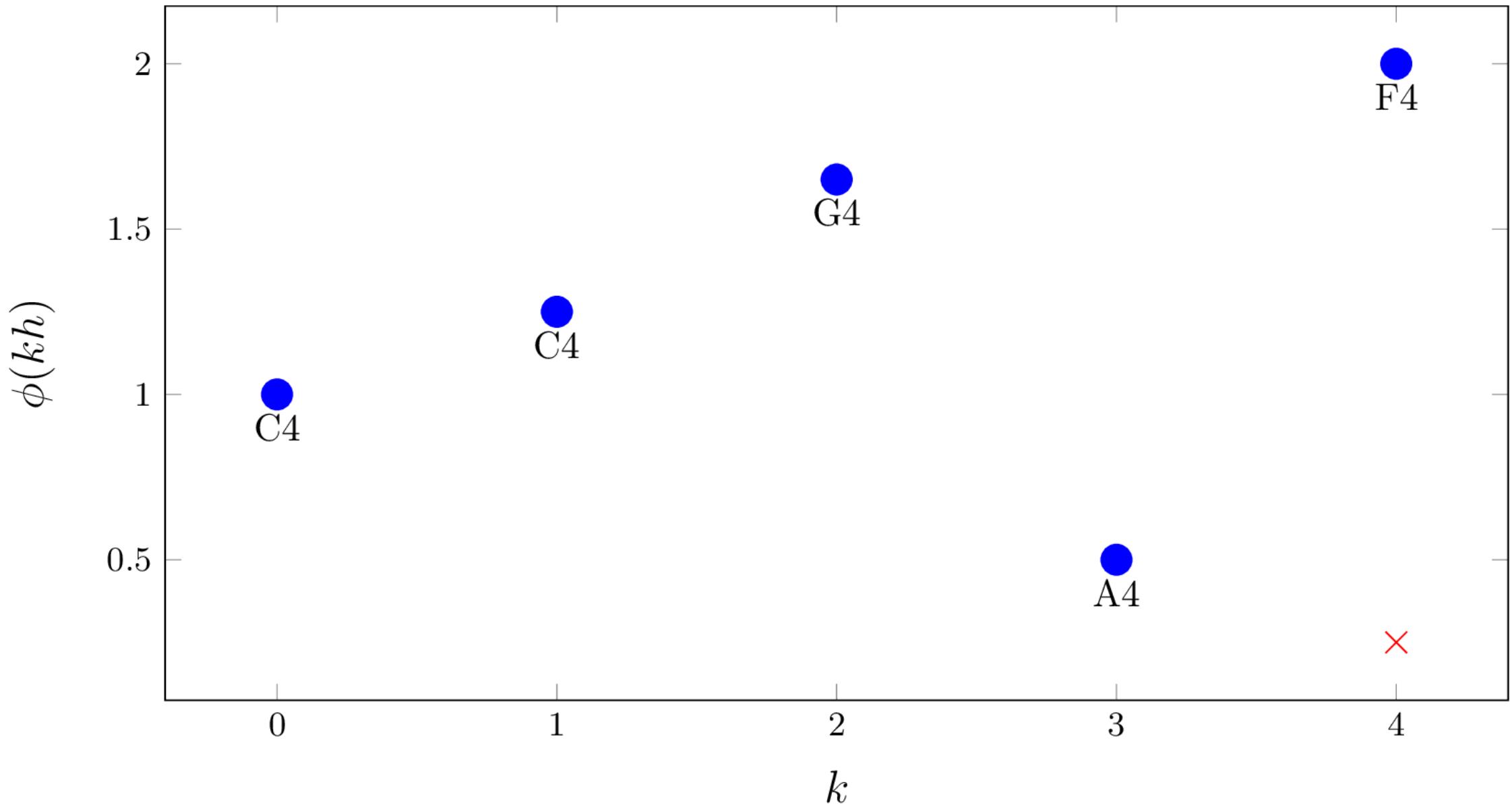
$$\{p'_k\}_{k=0}^4 = \{ C4, G4, C4, F4, ? \}$$

$$\alpha(\phi(kh)) = p_k$$

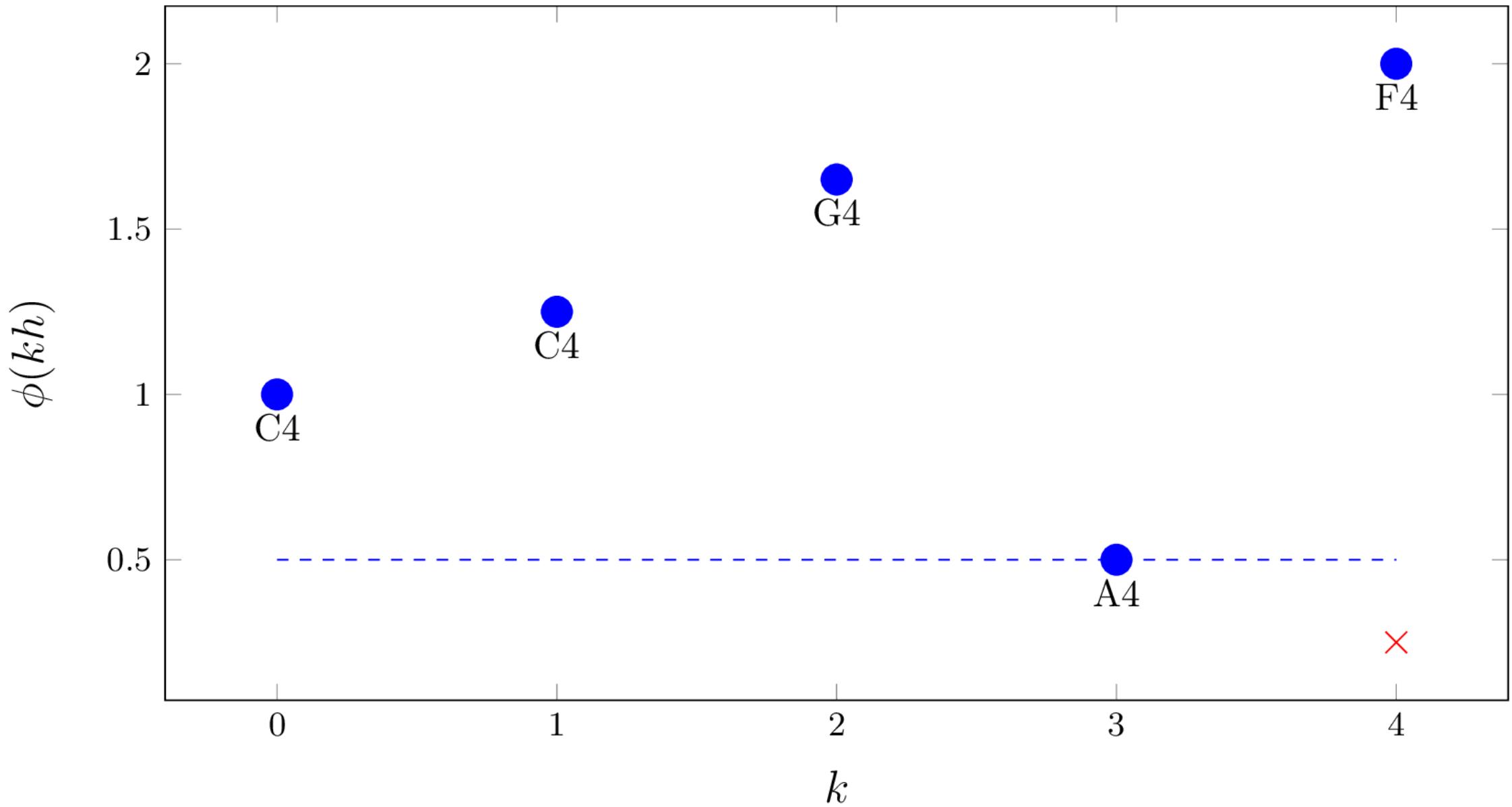
$$\dot{x} = f(t, x), x(0) = x_0$$

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# Overview of Our Method



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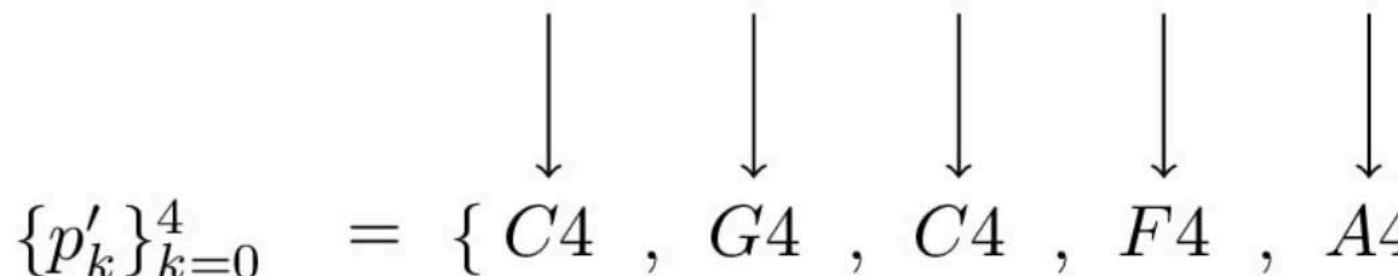
# Overview of Our Method

$$\{p_k\}_{k=0}^4 = \{ C4, C4, G4, A4, F4 \}$$



$$\{\phi(kh)\}_{k=0}^4 = \{1.00, 1.25, 1.65, 0.50, 2.00\}$$

$$\{\tilde{\phi}(kh)\}_{k=0}^4 = \{1.10, 1.45, 0.75, 2.25, 0.25\}$$



$$\{p'_k\}_{k=0}^4 = \{ C4, G4, C4, F4, A4 \}$$

$$\alpha(\phi(kh)) = p_k$$

$$\dot{x} = f(t, x), x(0) = x_0$$

$$\dot{x} = f(t, x), x(0) = \tilde{x}_0$$

# Overview of Our Method

Following the mapping, we obtain:

$$\beta(\tilde{\phi}(kh)) := \begin{cases} \alpha(\phi(b)) & \text{if } \exists a, b \in \text{dom } (\phi; m, h) \text{ s.t. } \phi(a) < \tilde{\phi}_1(kh) \leq \phi(b) \\ & \text{and } \nexists c \in \text{dom } (\phi; m, h) \text{ s.t. } \phi(a) < \phi(c) \leq \phi(b), \\ \alpha(\min\{\phi(t)\}) & \text{if } \tilde{\phi}_1(kh) < \phi(t) \text{ for all } t \in \text{dom } (\phi; m, h), \\ \alpha(\max\{\phi(t)\}) & \text{if } \phi(t) < \tilde{\phi}_1(kh) \text{ for all } t \in \text{dom } (\phi; m, h), \end{cases}$$

where

$$\text{dom } (\phi; m, h) = \{0, 0.01, 0.02, \dots, (m-1)h\}$$

# Main Idea of the Project

$$\{p_k\}_{k=0}^4 = \{C4, C4, G4, A4, F4\}$$

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$$\{p_k\}_{k=0}^4 = \{C4, C4, G4, A4, F4\}$$

↓ (Augmenting the Symbolic Music Dataset)

$$\{p_k^*\}_{k=0}^9 = \{C4, C4, C4, C4, G4, G4, A4, A4, F4, F4\}$$

# Main Idea of the Project

$$\{p_k\}_{k=0}^4 = \{C4, C4, G4, A4, F4\}$$

↓ (Augmenting the Symbolic Music Dataset)

$$\{p_k^*\}_{k=0}^9 = \{C4, C4, C4, C4, G4, G4, A4, A4, F4, F4\}$$

↓ (Overview of Our Method)

$$\{p'_k\}_{k=0}^9 = \{G4, C4, A4, G4, F4, F4, C4, C4, F4, C4\}$$

# Main Idea of the Project

$$\{p_k\}_{k=0}^4 = \{C4, C4, G4, A4, F4\}$$

↓ (Augmenting the Symbolic Music Dataset)

$$\{p_k^*\}_{k=0}^9 = \{C4, C4, C4, C4, G4, G4, A4, A4, F4, F4\}$$

↓ (Overview of Our Method)

$$\{p'_k\}_{k=0}^9 = \{G4, C4, A4, G4, F4, F4, C4, C4, F4, C4\}$$

↓ (Construct the New Variation)

$$\{\dot{p}_k\}_{k=0}^4 = \{G4, A4, F4, C4, F4\}$$

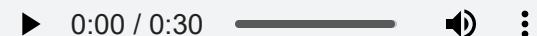
Showcases

Showcases

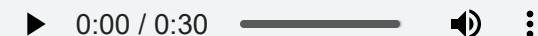
# Showcases

Pachelbel - Canon In D

**Original**



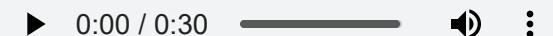
**Variation**



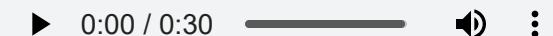
# Showcases

Yiruma, (이루마) - River Flows in You

Original



Variation



# Showcases

[https://ataetano.github.io/amm\\_presentation/presentation.html#1](https://ataetano.github.io/amm_presentation/presentation.html#1)