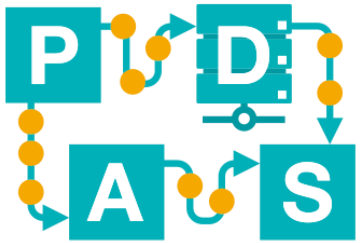
Conformance Checking

Alignments

BPI-Instruction 9



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Exercise 1

What is the cost of replaying the following trace on the given model?

$\langle a, b, d, e, g \rangle$

Exercise 1 Solution

What is the cost of replaying the following trace on the given model? 2

$\langle a, b, d, e, g \rangle$

Is there any other optimal alignment?

Log	a	»	b	d	e	g
Model	a	c	»	d	e	g

move in log only

move in model only

synchronous move (move in both)

Log	a	b	»	d	e	g
Model	a	»	c	d	e	g

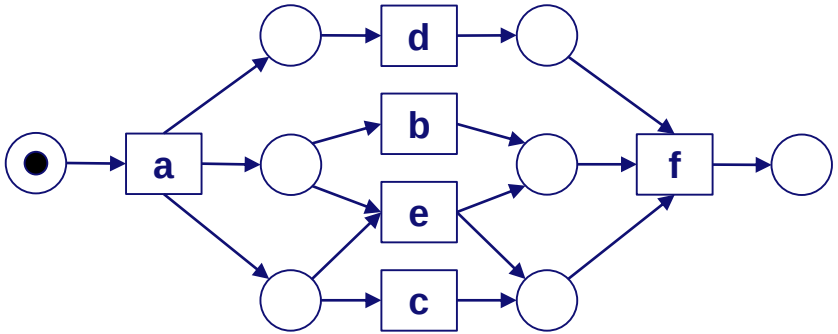
Exercise 2

1. What is the closest path to the following trace in the given model? What is the cost of this alignment?

2. How many optimal alignments are possible between the given model and trace?

3. What is the fitness based on the alignment?

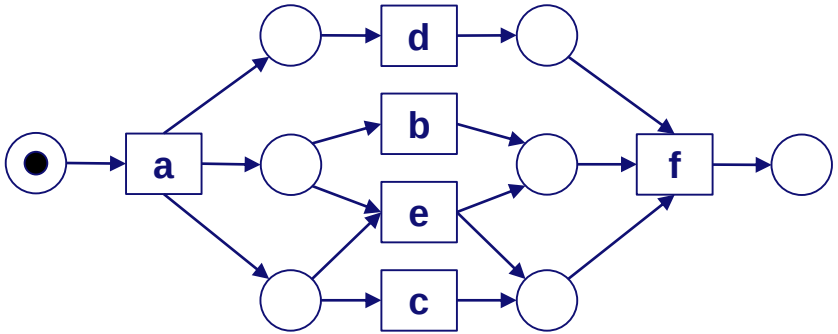
$\langle a, e, c, d \rangle$



Exercise 2 Solution

Which of the following alignments are correct?

$\langle a, e, c, d \rangle$



Log	a	c	e	d	>>
Model	a	>>	e	d	f

Log	a	e	c	d	>>
Model	a	e	>>	d	f

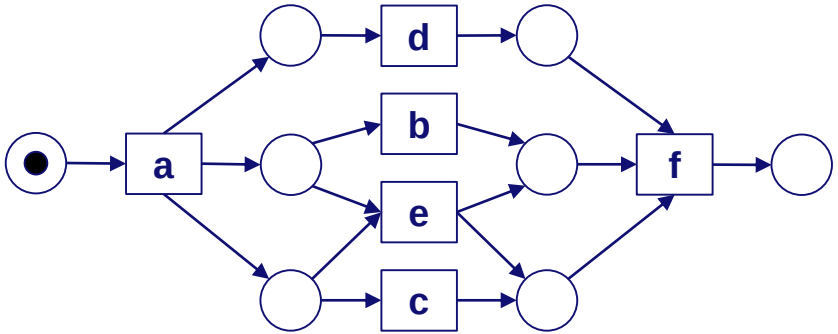
Log	a	e	c	d	>>
Model	a	e	c	d	f

Log	a	e	>>	c	d	>>
Model	a	>>	b	c	d	f

Exercise 2 Solution

Which of the following alignments are correct?

$\langle a, e, c, d \rangle$



Log	a	c	e	d	>>
Model	a	>>	e	d	f

Log	a	e	c	d	>>
Model	a	e	>>	d	f

Log	a	e	c	d	>>
Model	a	e	c	d	f

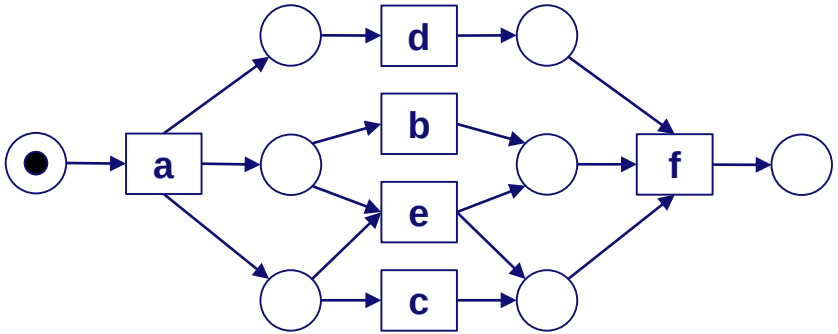
Log	a	e	>>	c	d	>>
Model	a	>>	b	c	d	f

Exercise 2 Solution

1. What is the closest path to the following trace in the given model? What is the cost of this alignment? 2

2. How many optimal alignments are possible between the given model and trace? 1

$\langle a, e, c, d \rangle$



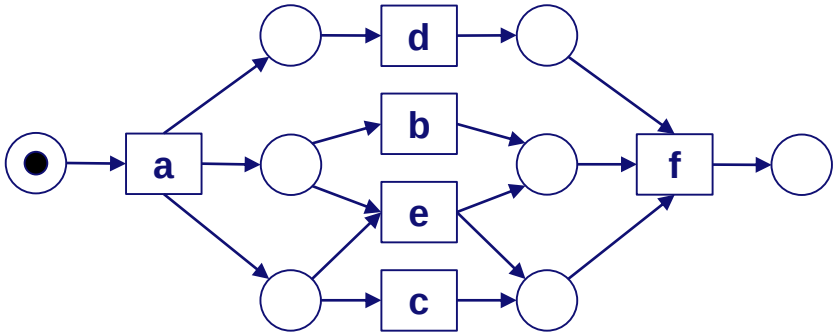
Log	a	e	c	d	>>
Model	a	e	>>	d	f

Log	a	e	c	d	>>	>>
Model	a	>>	c	d	b	f

Exercise 2 Solution

3. What is the fitness based on the alignment? 0.75

$\langle a, e, c, d \rangle$



optimal alignment:

Log	a	e	c	d	>>
Model	a	e	>>	d	f

worst case scenario:

Log	a	e	c	d	>>	>>	>>	>>
Model	>>	>>	>>	>>	a	e	d	f

Fitness: $1 - \frac{cost\_optimal\_alignment}{cost\_worst\_case} = 1 - \frac{2}{4+4} = 0.75$

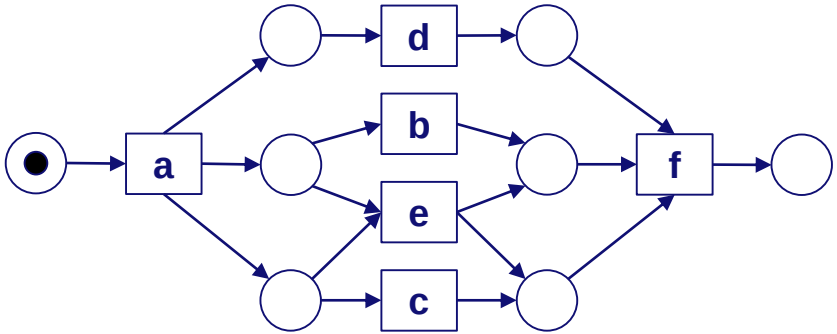
?

Length of the trace + shortest firing sequence on the model

Exercise 3

What is the fitness based on the alignment for the given trace and model?

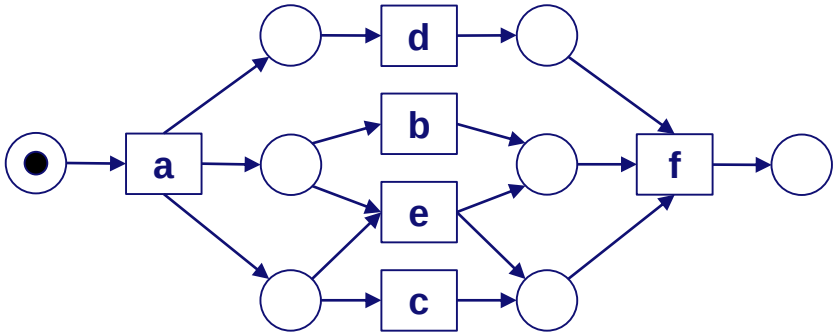
$\langle a \rangle$



Exercise 3 Solution

What is the fitness based on the alignment for the given trace and model?

$\langle a \rangle$



Log	a	>>	>>	>>
Model	a	e	d	f

Fitness: $1 - \frac{cost\_optimal\_alignment}{cost\_worst\_case} = 1 - \frac{3}{1+4} = 0.4$

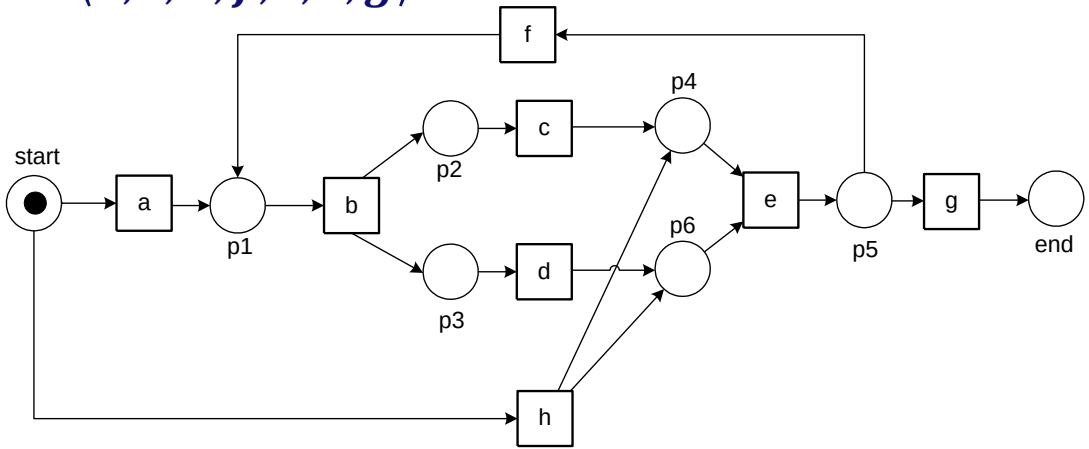
Exercise 4

1. What is the closest path to the following trace in the given model? What is the cost of this alignment?

2. How many optimal alignments are possible between the given model and trace?

3. What is the fitness based on the alignment?

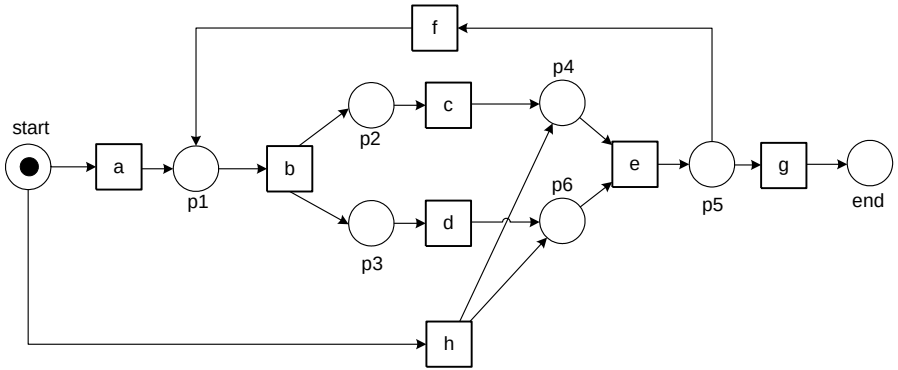
$\langle a, c, d, f, c, e, g \rangle$



Exercise 4

Which of the following alignments are correct?

$\langle a, c, d, f, c, e, g \rangle$



Log	a	>>	d	c	f	c	e	g
Model	a	b	d	c	>>	>>	e	g

Log	a	>>	c	d	>>	f	>>	c	>>	e	g
Model	a	b	c	d	e	f	b	c	d	e	g

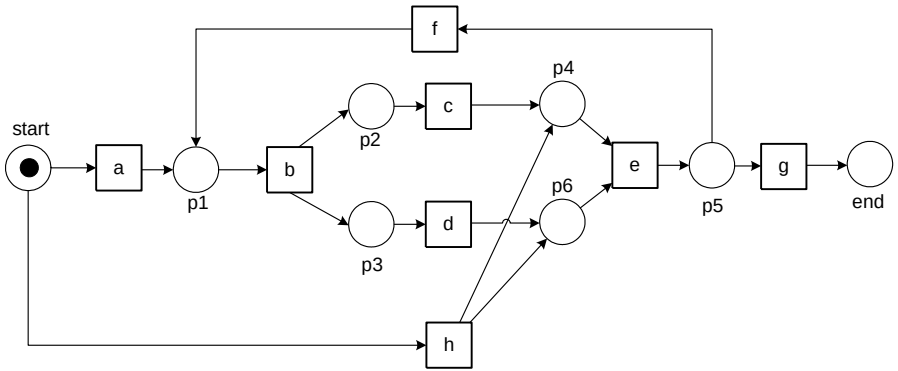
Log	a	>>	c	d	>>	f	>>	c	e	g
Model	a	b	c	d	e	f	b	c	e	g

Log	a	>>	c	d	f	c	e	g
Model	a	b	c	d	>>	>>	e	g

Exercise 4

Which of the following alignments are correct?

$\langle a, c, d, f, c, e, g \rangle$



Log	a	>>	d	c	f	c	e	g
Model	a	b	d	c	>>	>>	e	g

Log	a	>>	c	d	>>	f	>>	c	>>	e	g
Model	a	b	c	d	e	f	b	c	d	e	g

Log	a	>>	c	d	>>	f	>>	c	e	g
Model	a	b	c	d	e	f	b	c	e	g

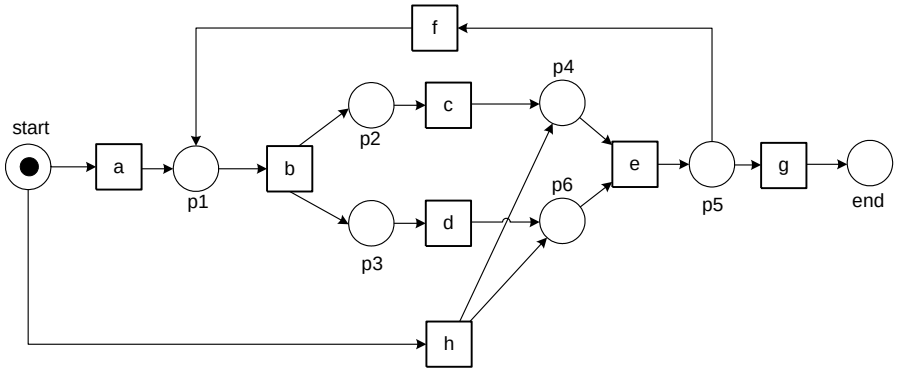
Log	a	>>	c	d	f	c	e	g
Model	a	b	c	d	>>	>>	e	g

Exercise 4 Solution

1. What is the closest path to the following trace in the given model? What is the cost of this alignment? 3

2. How many optimal alignments are possible between the given model and trace?

$$\langle a, c, d, f, c, e, g \rangle$$



Log	a	>>	c	d	f	c	e	g
Model	a	b	c	d	>>	>>	e	g

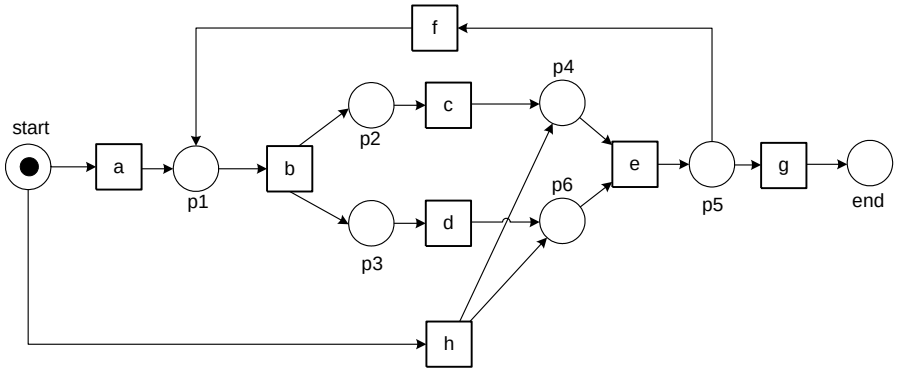
Exercise 4 Solution

1. What is the closest path to the following trace in the given model? What is the cost of this alignment? 3

2. How many optimal alignments are possible between the given model and trace? 3

3. What is the fitness based on the alignment?

$$\langle a, c, d, f, c, e, g \rangle$$



Log	a	>>	c	d	f	c	e	g
Model	a	b	c	d	>>	>>	e	g

Log	a	>>	c	d	f	c	e	g
Model	a	b	>>	d	>>	c	e	g

Log	a	c	>>	d	f	c	e	g
Model	a	>>	b	d	>>	c	e	g

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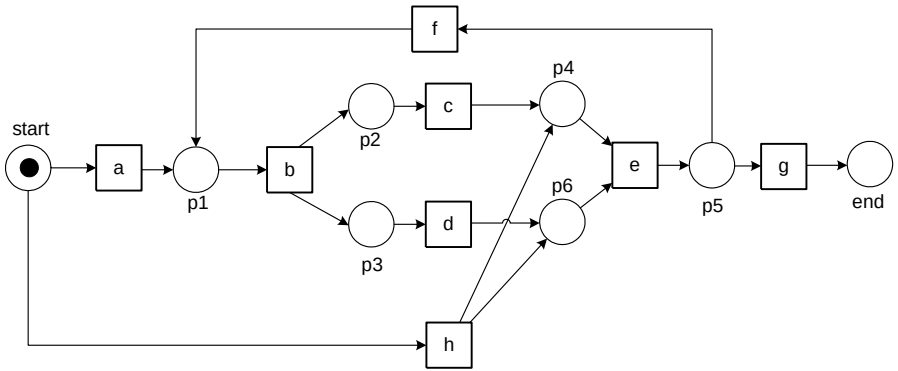
Exercise 4 Solution

3. What is the fitness based on alignment? 0.7

$\langle a, c, d, f, c, e, g \rangle$



optimal alignment:

Log	a	>>	c	d	f	c	e	g
Model	a	b	c	d	>>	>>	e	g

worst case scenario:

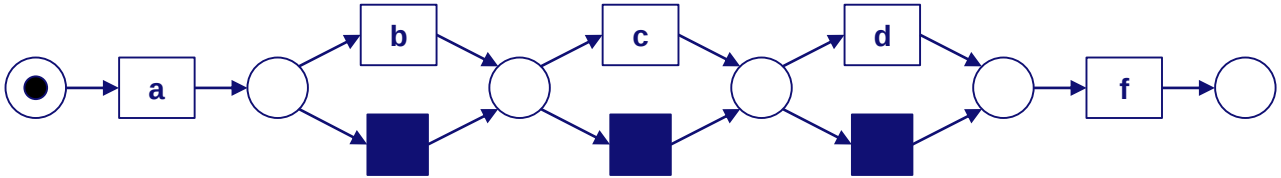
Log	a	c	d	f	c	e	g	>>	>>	>>
Model	>>	>>	>>	>>	>>	>>	>>	h	e	g

Fitness: $1 - \frac{cost\_optimal\_alignment}{cost\_worst\_case} = 1 - \frac{3}{10} = 0.7$

Exercise 5

What is the fitness based on the alignment for the given trace and the model?

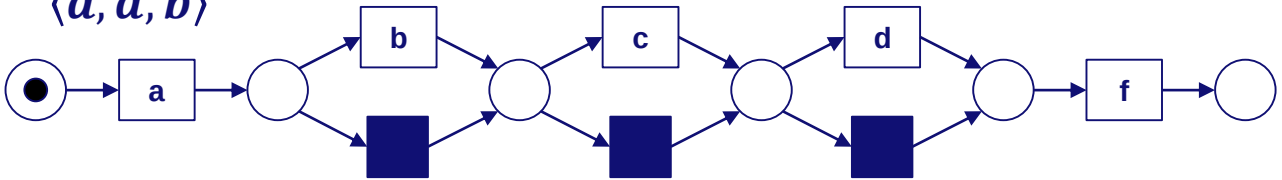
$\langle a, d, b \rangle$



Exercise 5 Solution

What is the fitness based on the alignment for the given trace and the model?

$\langle a, d, b \rangle$



optimal alignment:

Costs

Log	a	>>	>>	d	b	>>
Model	a	τ	τ	d	>>	f

worst case scenario:

Log	a	d	b	>>	>>	>>	>>	>>
Model	>>	>>	>>	a	τ	τ	τ	f

Fitness: $1 - \frac{cost\_optimal\_alignment}{cost\_worst\_case} = 1 - \frac{2}{5}$

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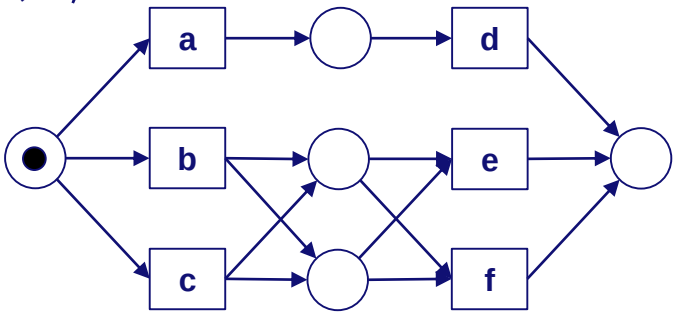
Exercise 6

1. What is the fitness based on the alignment for the given trace and the model?
2. How many optimal alignments are there?

$\langle b, d \rangle$

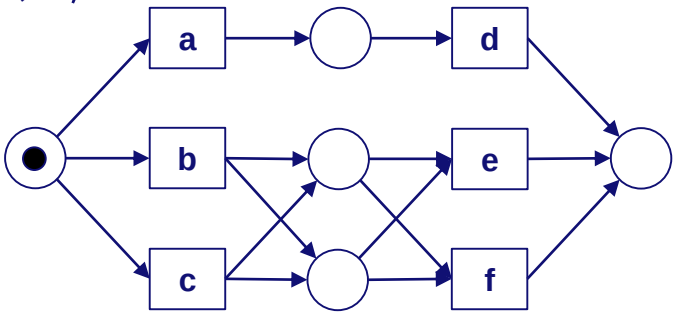


Exercise 6 Solution

1. What is the fitness based on the alignment for the given trace and the model?

2. How many optimal alignments are there?

$\langle b, d \rangle$



Log	b	>>	d
Model	b	e	>>

Log	b	>>	d
Model	b	f	>>

Log	b	>>	d
Model	>>	a	d

Log	b	d	>>
Model	b	>>	e

Log	b	d	>>
Model	b	>>	f

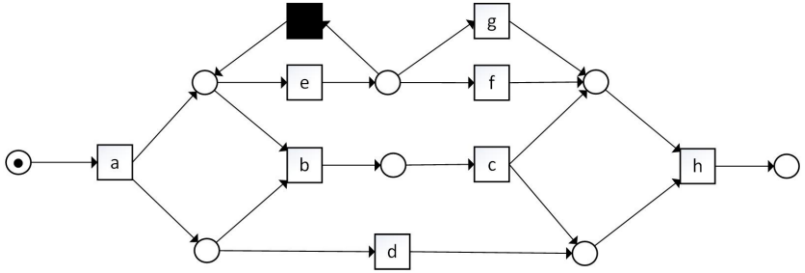
Log	>>	b	d
Model	a	>>	d

Fitness: $1 - \frac{cost\_optimal\_alignment}{cost\_worst\_case} = 1 - \frac{2}{2+2} = 0.50$

Exercise 7

Complete the following table and then calculate the overall fitness.

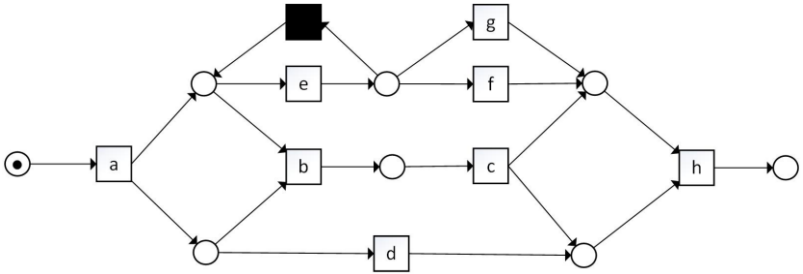
$$L = [\langle a, b, c\rangle^{25}, \langle a, b, d\rangle^{5}, \langle a, e, d, h\rangle^{20}, \langle a, e, b, c, h\rangle^{50}]$$



	frequency	Optimal alignment cost	Number of optimal alignments	Alignment fitness
$\langle a, b, c\rangle$	25			
$\langle a, b, d\rangle$	5			
$\langle a, e, d, h\rangle$	20			
$\langle a, e, b, c, h\rangle$	50			

Exercise 7 Solution

$\langle a, b, c \rangle$



Fitness: $1 - \frac{1}{3+4} = 0.86$

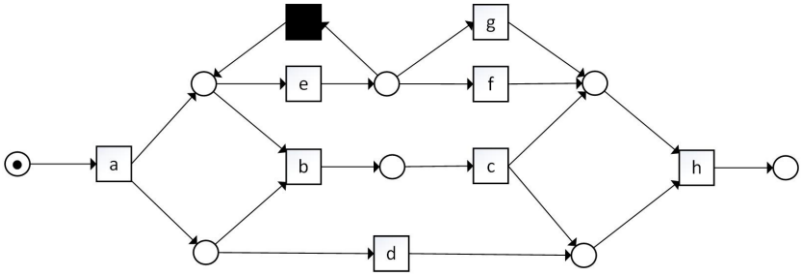
Cost for optimal alignment	Number of optimal alignment	Alignment fitness
1	1	0.86

Optimal alignments:

a	b	c	>>
a	b	c	h

Exercise 7 Solution

$\langle a, b, d \rangle$



Fitness: $1 - \frac{3}{3+4} = 0.57$

Cost for optimal alignment	Number of optimal alignment	Alignment fitness
3	3	0.57

Optimal alignments:

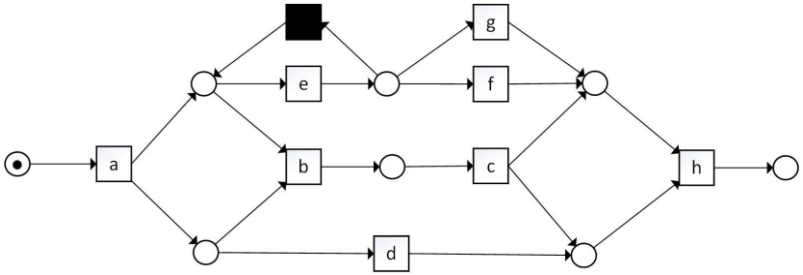
a	b	d	>>	>>
a	b	>>	c	h

a	b	>>	d	>>
a	b	c	>>	h

a	b	>>	>>	d
a	b	c	h	>>

Exercise 7 Solution

$\langle a, e, d, h \rangle$



Fitness: $1 - \frac{1}{4+4} = 0.88$

Cost for optimal alignment	Number of optimal alignment	Alignment fitness
1	4	0.88

Optimal alignments:

a	e	d	>>	h
a	e	d	f	h

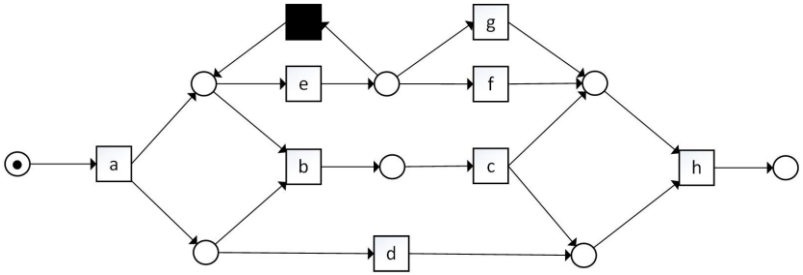
a	e	d	>>	h
a	e	d	g	h

a	e	>>	d	h
a	e	g	d	h

a	e	>>	d	h
a	e	f	d	h

Exercise 7 Solution

$\langle a, e, b, c, h \rangle$



Fitness: $1 - \frac{0}{5+4} = 1$

Cost for optimal alignment	Number of optimal alignment	Alignment fitness
0	1	1

Optimal alignments:

a	e	>>	b	c	h
a	e	τ	b	c	h

Exercise 7 Solution

	frequency	Optimal alignment cost	Number of optimal alignments	Alignment fitness
$\langle a, b, c \rangle$	25	1	1	0.86
$\langle a, b, d \rangle$	5	3	3	0.57
$\langle a, e, d, h \rangle$	20	1	4	0.88
$\langle a, e, b, c, h \rangle$	50	0	1	1

Alignment Fitness: $\frac{25 \cdot 0.86 + 5 \cdot 0.57 + 20 \cdot 0.88 + 50 \cdot 1}{25 + 5 + 20 + 50} = 0.92$