IN-CLASS EXERCISE (I4)

Student ID: ..... Duration: 15 mins Date: 05/04/2023

Student name: ..... Score: ...../ 3

Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

a. P(F(A), G(y)) and P(x, x) where A is a constant symbol

.....

b. P(B, x, F(G(z))) and P(z, F(y), F(y)) where B is a constant symbol

.....

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Truffle is an edible mushroom, and it is not colorful.
2	0.25	All mushrooms grow in some forests.
3	0.25	There are some forests in which no edible mushroom grows.
4	0.25	No mushroom grows in all forests.
5	0.5	There is exactly one colorful mushroom.
6	0.5	Each mushroom is colorful or edible (but not both at the same time).

using only the given predicates

- Mushroom(x): x is a mushroom
- Edible(x): x is edible
- Forest(x): x is a forest
- Truffle is a constant
- Colorful(x): x is colorful
- Grows(x, y): x grows in y

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Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

a. P(x, x) and P(z, F(z))

.....

b. Q(A, G(x, A), F(y)) and Q(A, G(F(B), A), x) where A and B are constant symbols

.....

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Taiga is forest, but it is neither tropical nor dense.
2	0.25	Each forest has some ferns growing in there.
3	0.25	There is some fern that grows in no tropical forest.
4	0.25	There is no forest in which all ferns grow.
5	0.5	There are at least two dense forests.
6	0.5	Each forest is tropical or sparse (but both at different times).

using only the given predicates

- Fern(x): x is a fern
- Taiga is a constant
- Tropical(x): x is tropical
- Dense(x): x is dense
- Forest(x): x is a forest
- Grows(x, y): x grows in y

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Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

a. F(G(A, x), G(y, y)) and F(G(A, B), G(F(A), F(z))) where A and B are constant symbols

.....

b. Q(A, y, x) and Q(x, B, F(y)) where A and B are constant symbols

.....

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Margherita is a cheesy pizza, but it is not spicy.
2	0.25	Each café serves some pizzas.
3	0.25	Some cafés serve no spicy pizza.
4	0.25	There is no pizza that all cafés serve.
5	0.5	There is exactly one spicy pizza.
6	0.5	Each pizza is spicy or cheesy (but not both simultaneously).

using only the given predicates

- Pizza(x): x is a pizza
- Margherita is constant
- Spicy(x): x is spicy
- Cheesy(x): x is cheesy
- Cafe(x): x is a café
- Serves(x, y): x serves y

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Student name: ..... Score: ...../ 3

Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

a. F(Cons(Cons(A, B))) and F(Cons(Cons(x, N))) where A, B, and N are constant symbols

.....

b. Q(C, F(x), y) and Q(x, F(z), G(z, z)) where C is a constant symbol

.....

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Buffalo is a spicy pizza, and it is not a topping.
2	0.25	All pizzas contain some toppings.
3	0.25	Some pizzas contain no cheesy topping.
4	0.25	There is no topping that all pizzas contain.
5	0.5	Buffalo pizza contains at least two toppings.
6	0.5	Some topping is cheesy or contained in Buffalo (but not both at the same time).

using only the given predicates

- Pizza(x): x is a pizza
- Spicy(x): x is spicy
- Topping(x): x is a topping
- Buffalo is constant
- Cheesy(x): x is cheesy
- Contains(x, y): x contains y

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SOLUTION

IN-CLASS EXERCISE (I4)

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Student name: ..... Score: ...../ 3

Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

c. P(F(A), G(y)) and P(x, x) where A is a constant symbol

No MGU. We cannot unify x with both F(A) and G(y), these two predicates are not unifiable.

d. P(B, x, F(G(z))) and P(z, F(y), F(y)) where B is a constant symbol

θ = { z/B, x/F(y), y/G(B) }

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Truffle is an edible mushroom, and it is not colorful.
2	0.25	All mushrooms grow in some forests.
3	0.25	There are some forests in which no edible mushroom grows.
4	0.25	No mushroom grows in all forests.
5	0.5	There is exactly one colorful mushroom.
6	0.5	Each mushroom is colorful or edible (but not both at the same time).

using only the given predicates

- Mushroom(x): x is a mushroom
- Truffle is a constant
- Edible(x): x is edible
- Colorful(x): x is colorful
- Forest(x): x is a forest
- Grows(x, y): x grows in y

7. Mushroom(Truffle) ∧ Edible(Truffle) ∧ ¬Colorful(Truffle)
8. ∀x Mushroom(x) → [∃y Forest(y) ∧ Grows(x, y)]
9. ∃x Forest(x) ∧ [∀y Mushroom(y) ∧ Edible(y) → ¬Grows(y, x)]
10. ¬∃x Mushroom(x) ∧ [∀y Forest(y) → Grows(x, y)]
11. ∃x Mushroom(x) ∧ Colorful(x) ∧ [∀y Mushroom(y) ∧ ¬ (x = y) → ¬Colorful(y)]
12. ∀x Mushroom(x) → Colorful(x) ↔ ¬Edible(x)

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Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

c. P(x, x) and P(z, F(z))

No MGU. We can not unify x with both z and F(z), which are not unifiable.

d. Q(A, G(x, A), F(y)) and Q(A, G(F(B), A), x) where A and B are constant symbols

θ = { x/F(B), y/B }

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Taiga is forest, but it is neither tropical nor dense.
2	0.25	Each forest has some ferns growing in there.
3	0.25	There is some fern that grows in no tropical forest.
4	0.25	There is no forest in which all ferns grow.
5	0.5	There are at least two dense forests.
6	0.5	Each forest is tropical or sparse (but both at different times).

using only the given predicates

- Fern(x): x is a fern
- Taiga is a constant
- Tropical(x): x is tropical
- Dense(x): x is dense
- Forest(x): x is a forest
- Grows(x, y): x grows in y

7. Forest(Taiga) ∧ ¬Tropical(Taiga) ∧ ¬Dense(Taiga)
8. ∀x Forest(x) → [∃y Fern(y) ∧ Grows(y, x)]
9. ∃x Fern(x) ∧ [¬∃y Forest(y) ∧ Tropical(y) ∧ Grows(x, y)]
10. ¬∃x Forest(x) ∧ [∀y Fern(y) → Grows(y, x)]
11. ∃x, y Forest(x) ∧ Forest(y) ∧ Dense(x) ∧ Dense(y) ∧ ¬ **(x = y)**
12. ∀x Forest(x) → Tropical(x) ↔ Dense(x)

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Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

c. F(G(A, x), G(y, y)) and F(G(A, B), G(F(A), F(z))) where A and B are constant symbols

θ = { x/B, y/F(A), z/A }

d. Q(A, y, x) and Q(x, B, F(y)) where A and B are constant symbols

No MGU. We can not unify x with both A and F(y), which are not unifiable.

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Margherita is a cheesy pizza, but it is not spicy.
2	0.25	Each café serves some pizzas.
3	0.25	Some cafés serve no spicy pizza.
4	0.25	There is no pizza that all cafés serve.
5	0.5	There is exactly one spicy pizza.
6	0.5	Each pizza is spicy or cheesy (but not both simultaneously).

using only the given predicates

- Pizza(x): x is a pizza
- Margherita is constant
- Spicy(x): x is spicy
- Cheesy(x): x is cheesy
- Cafe(x): x is a café
- Serves(x, y): x serves y

7. $Pizza(Margherita) \land Cheesy(Margherita) \land \neg Spicy(Margherita)$
8. $\forall x\ Cafe(x) \rightarrow [\ \exists y\ Pizza(y) \land Serves(x, y)\ ]$
9. $\exists x\ Café(x) \land [\ \forall y\ Pizza(y) \land Spicy(y) \rightarrow \neg Serves(x, y)\ ]$
10. $\neg\exists x\ Pizza(x) \land [\ \forall y\ Café(y) \rightarrow Serves(y, x)\ ]$
11. $\exists x\ Pizza(x) \land Spicy(x) \land [\forall y\ Pizza(y) \land \neg\ (x = y) \rightarrow \neg Spicy(y)\ ]$
12. $\forall x\ Pizza(x) \rightarrow Spicy(x) \leftrightarrow \neg Cheesy(x)$

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Question 1 (1pt) Find the MGU for each of the following pairs of clauses. If there exists such an MGU, write the substitution θ. Otherwise, write No MGU and justify your answer.

c. F(Cons(Cons(A, B))) and F(Cons(Cons(x, N))) where A, B, and N are constant symbols

No MGU. We cannot unify two different constants.

d. Q(C, F(x), y) and Q(x, F(z), G(z, z)) where C is a constant symbol

θ = { x/C, z/C, y/G(C, C) }

Question 2 (2pts) Translate the following sentences from English to First-order logic.

No.	*Score (pt)*	*Sentence*
1	0.25	Buffalo is a spicy pizza, and it is not a topping.
2	0.25	All pizzas contain some toppings.
3	0.25	Some pizzas contain no cheesy topping.
4	0.25	There is no topping that all pizzas contain.
5	0.5	Buffalo pizza contains at least two toppings.
6	0.5	Some topping is cheesy or contained in Buffalo (but not both at the same time).

using only the given predicates

- Pizza(x): x is a pizza
- Buffalo is constant
- Spicy(x): x is spicy
- Cheesy(x): x is cheesy
- Topping(x): x is a topping
- Contains(x, y): x contains y

7. $Pizza(Buffalo) \land Spicy(Buffalo) \land \neg Topping(Buffalo)$
8. $\forall x\ Pizza(x) \rightarrow [\exists y\ Topping(y) \land Contains(x, y)]$
9. $\exists x\ Pizza(x) \land [\forall y\ Cheesy(y) \land Topping(y) \rightarrow \neg Contains(x, y)]$
10. $\neg\exists x\ Topping(x) \land [\forall y\ Pizza(y) \rightarrow Contains(y, x)]$
11. $\exists x\ Topping(x) \land Topping(y) \land \neg (x = y) \land Contains(Buffalo, x) \land Contains(Buffalo, y)$
12. $\exists x\ Topping(x) \land [Contains(Buffalo, x) \leftrightarrow \neg Cheesy(x)]$