IN-CLASS EXERCISE (I4)

Student ID: ..... Duration: 15 mins Date: 13/04/2023

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(P(x, y), P(x, z)) and P(z, P(A, P(y, x))) where A is a constant symbol

.....

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

.....

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

No.	*Score (pt)*	*Sentence*
1	0.25	Fish oil is a non-saturated fat, and thus it is healthy.
2	0.25	Every dish contains some fats.
3	0.25	Some dishes do not contain any kind of saturated fat.
4	0.25	Not every fat is contained in all dishes.
5	0.5	Only one unhealthy fat is non-saturated.
6	0.5	All kind of fats are saturated or healthy (but not both at the same time).

using only the given predicates

- Dish(x): x is a dish
- Fish oil is a constant
- Fat(x): x is a kind of fat
- Saturated(x): x is saturated
- Contains(x, y): x contains y
- Healthy(x): x is healthy

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

.....

b. Q(F(A), A, z) and Q(F(x), y, G(B)) 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	Beefsteak is a delicious dish, yet it is unhealthy.
2	0.25	Every dish contains some sauce.
3	0.25	Some sauces are not contained in all awful dishes.
4	0.25	Not every dish contains all sauces.
5	0.5	Beefsteak dish contains exactly one kind of sauce.
6	0.5	Each dish is delicious or healthy (but not both simultaneously).

using only the given predicates

- Dish(x): x is a dish
- Beefsteak is a constant
- Sauce(x): x is a kind of sauce
- Delicious(x): x is delicious (whose opposite is awful)
- Contains(x, y): x contains y
- Healthy(x): x is healthy

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

.....

b. R(F(x), A) and R(y, F(w)) where A is a constant symbol

.....

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

No.	*Score (pt)*	*Sentence*
1	0.25	Any berry is sour or inedible.
2	0.25	Every pie includes some berries.
3	0.25	Some pie includes no sweet berry.
4	0.25	There is no berry that all pies do not include.
5	0.5	There are at least two sweet berries
6	0.5	Each berry is either edible or sweet (but both at different times).

using only the given predicates

- Berry(x): x is a berry
- Edible(x): x is edible
- Sour(x): x is sour (whose opposite is sweet)
- Pie(x): x is a pie
- Includes(x, y): x includes 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. S(x, G(x), x) and S(G(u), G(G(z)), z)

.....

b. S (A, x, G(y, y)) S (y, B, z) 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	Strawberry is sour, and it is not an inedible berry.
2	0.25	Every berry grows in some gardens.
3	0.25	There are some gardens that no sweet berry grows.
4	0.25	Not all berries grow in some gardens.
5	0.5	There is exactly one inedible berry.
6	0.5	Each garden has something that is a berry or inedible (but both at different times).

using only the given predicates

- Berry(x): x is a berry
- Strawberry is a constant
- Edible(x): x is edible
- Sour(x): x is sour (whose opposite is sweet)
- Garden(x): x is a garden
- Grows(x, y): x grows in y

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SOLUTION

IN-CLASS EXERCISE (I4)

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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(P(x, y), P(x, z)) and P(z, P(A, P(y, x))) where A is a constant symbol

θ = { z/P(x, y), x/A, y/A }

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

No MGU. y cannot unify with two functions of different concepts.

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

No.	*Score (pt)*	*Sentence*
1	0.25	Fish oil is a non-saturated fat, and thus it is healthy.
2	0.25	Every dish contains some fats.
3	0.25	Some dishes do not contain any kind of saturated fat.
4	0.25	Not every fat is contained in all dishes.
5	0.5	Only one unhealthy fat is non-saturated.
6	0.5	All kind of fats are saturated or healthy (but not both at the same time).

Using only the given predicates

- Dish(x): x is a dish
- Fish oil is a constant
- Fat(x): x is a kind of fat
- Saturated(x): x is saturated
- Contains(x, y): x contains y
- Healthy(x): x is healthy

1. Fat(Fish oil) ∧ ¬Saturated(Fish oil) ∧ Healthy(Fish oil)
2. ∀x Dish(x) → [∃y Fat(y) ∧ Contains(x, y)]
3. ∃x Dish(x) ∧ [∀y Fat(y) ∧ Saturated(y) → ¬Contains(x, y)]
4. ¬∀x Fat(x) → [∀y Dish(y) → Contains(y, x)]
5. ∃x Fat(x) ∧ ¬Healthy(x) ∧ ¬Saturated(x) ∧ [∀y Fat(y) ∧ ¬Healthy(y) ∧ ¬(x = y) → Saturated(y)]
6. ∀x Fat(x) → Saturated(x) ↔ ¬Healthy(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.

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

No MGU. x cannot unify with both constants A and B

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

θ = { x/A, y/A, z/G(B) }

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

No.	*Score (pt)*	*Sentence*
1	0.25	Beefsteak is a delicious dish, yet it is unhealthy.
2	0.25	Every dish contains some sauce.
3	0.25	Some sauces are not contained in all awful dishes.
4	0.25	Not every dish contains all sauces.
5	0.5	Beefsteak dish contains exactly one kind of sauce.
6	0.5	Each dish is delicious or healthy (but not both simultaneously).

using only the given predicates

- Dish(x): x is a dish
- Beefsteak is a constant
- Sauce(x): x is a kind of sauce
- Delicious(x): x is delicious (whose opposite is awful)
- Contains(x, y): x contains y
- Healthy(x): x is healthy

1. $Dish(Beefsteak) \land Delicious(Beefsteak) \land \neg Healthy(Beefsteak)$
2. $\forall x\ Dish(x) \rightarrow [\ \exists y\ Sauce(y) \land Contains(x, y)\ ]$
3. $\exists x\ Sauce(x) \land [\ \forall y\ Dish(y) \land \neg Delicious(y) \rightarrow \neg Contains(y, x)\ ]$
4. $\neg \forall x\ Dish(x) \rightarrow [\ \forall y\ Sauce(y) \rightarrow Contains(x, y)\ ]$
5. $Dish(Beefsteak) \land \exists x\ Sauce(x) \land Contain(Beefsteak, x) \land$
   $[\ \forall y\ Sauce(y) \land \neg (x = y) \rightarrow \neg Contain(Beefsteak, y)\ ]$
6. $\forall x\ Dish(x) \rightarrow Delicious(x) \leftrightarrow \neg Healthy(x)$

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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.

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

θ = { x/A, y/A, z/G(B) }

b. R(F(x), A) and R(y, F(w)) where A is a constant symbol

No MGU. For the second argument, we cannot unify a constant and a function.

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

No.	*Score (pt)*	*Sentence*
1	0.25	Any berry is sour or inedible.
2	0.25	Every pie includes some berries.
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4	0.25	There is no berry that all pies do not include.
5	0.5	There are at least two sweet berries
6	0.5	Each berry is either edible or sweet (but both at different times).

using only the given predicates

- Berry(x): x is a berry
- Edible(x): x is edible
- Sour(x): x is sour (whose opposite is sweet)
- Pie(x): x is a pie
- Includes(x, y): x includes y

1. $\forall x\ Berry(x) \rightarrow Sour(x) \vee \neg Edible(x)$
2. $\forall x\ Pie(x) \rightarrow [\ \exists y\ Berry(y) \wedge Includes(x, y)\ ]$
3. $\exists x\ Pie(x) \wedge [\ \forall y\ Berry(y) \wedge \neg Sour(y) \rightarrow \neg Includes\ (x, y)\ ]$
4. $\neg\exists x\ \ Berry(x) \wedge [\ \forall y\ Pie(y) \rightarrow \neg Includes(y, x)\ ]$
5. $\exists x, y\ Berry(x) \wedge \neg Sour(x) \wedge Berry(y) \wedge \neg Sour(y)\ \neg(x = y)$
6. $\forall x\ \ Dish(x) \rightarrow Edible(x) \leftrightarrow \neg Sour(x)$

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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.

a. S(x, G(x), x) and S(G(u), G(G(z)), z)

No MGU. x cannot unify with G(z) and z at the same time.

b. S (A, x, G(y, y)) S (y, B, z) where A and B are constant symbols

θ = { y/A, x/B, z/G(A, A) }

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

No.	*Score (pt)*	*Sentence*
1	0.25	Strawberry is sour, and it is not an inedible berry.
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4	0.25	Not all berries grow in some gardens.
5	0.5	There is exactly one inedible berry.
6	0.5	Each garden has something that is a berry or inedible (but both at different times).

using only the given predicates

- Berry(x): x is a berry
- Strawberry is a constant
- Edible(x): x is edible
- Sour(x): x is sour (whose opposite is sweet)
- Garden(x): x is a garden
- Grows(x, y): x grows in y

1. Sour(Strawberry) ∧ ¬Edible(Strawberry) ∧ Berry(Strawberry)

   The above is meaningful. However, the exact translation should be

   Sour(Strawberry) ∧ ¬[¬Edible(Strawberry) ∧ Berry(Strawberry)]
2. ∀x Berry(x) → [∃y Garden(y) ∧ Grows(x, y)]
3. ∃x Garden(x) ∧ [∀y Berry(y) ∧ ¬Sour(y) → ¬Grows(y, x)]
4. ¬∀x Berry(x) ∧ → [∃y Garden(y) ∧ Grows(x, y)]
5. ∃x Berry(x) ∧ ¬Edible(x) ∧ [∀y Berry(y) ∧ ¬Indible(y) → ¬(x = y)]
6. ∀x Berry(x) → ∃y Edible(y) ↔ Berry(y)