Prolog

Exercises

Exercises from old exams:

Create a Prolog predicate called range(N, M, Res) that returns a list containing all the integer numbers from N to M. For example:

? - range(3, 7, Res).

Res = [3, 4, 5, 6, 7]

Exercises from old exams:

```
range(N,N,[N]):-!.

range(N,M,[N|Res]) :- N<M, N1 is N+1, range(N1, M, Res).
```

Exercises from old exams:

Write a Prolog predicate, called even(List, Res), that given a list, checks all the numerical elements and only returns the even ones, leaving all the non-numerical elements in the list. If the list contains sub-lists, they are considered as a non-numerical element and therefore have to be in the resulting list, no matter their content. For example:

? - even([1, 2, 3, 4], X).

X = [2,4].

? - even([1, 2, a, [3], 4, 5, b], X).

X = [2, a, [3], 4, b]

Exercises from old exams:

```
even([],[]).
even([H|T], [H|Res]) :- number(H), 0 is H mod 2, even(T, Res).
even([H|T], Res):- number(H), even(T, Res).
even([H|T], [H|Res]) :- even(T, Res).
```

CLP

Exercises

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

First step: **definition of the variables**

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Variables:

- PilotA, PilotB, PilotC, PilotD in {Mario, Luigi, Bowser, Peach}
- KartA, KartB, KartC, KartD in {basic, fast}
- ParachuteA, ParachuteB, ParachuteC, ParachuteD in {pink, orange, blue, yellow, white}

Second step: **definition of the constraints**

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser
- PilotA ≠ Peach

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser
- PilotA ≠ Peach
- AllDifferent(ParachuteA, ParachuteB, ParachuteC, ParachuteD)

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser
- PilotA ≠ Peach
- AllDifferent(ParachuteA, ParachuteB, ParachuteC, ParachuteD)
- For all J in {A, B, C, D}: PilotJ = Peach → ParachuteJ = pink

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser
- PilotA ≠ Peach
- AllDifferent(ParachuteA, ParachuteB, ParachuteC, ParachuteD)
- For all J in {A, B, C, D}: PilotJ = Peach → ParachuteJ = pink
- For all J in {A, B, C, D}: ParachuteJ = blue -> KartJ ≠ fast
  (or KartC ≠ fast or KartC = basic)

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser
- PilotA ≠ Peach
- AllDifferent(ParachuteA, ParachuteB, ParachuteC, ParachuteD)
- For all J in {A, B, C, D}: PilotJ = Peach → ParachuteJ = pink
- For all J in {A, B, C, D}: ParachuteJ = blue -> KartJ ≠ fast
  (or KartC ≠ fast or KartC = basic)
- KartD ≠ fast (or KartD = basic)

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Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Constraints:

- AllDifferent(PilotA, PilotB, PilotC, PilotD)
- PilotB ≠ Bowser
- PilotA ≠ Peach
- AllDifferent(ParachuteA, ParachuteB, ParachuteC, ParachuteD)
- For all J in {A, B, C, D}: PilotJ = Peach → ParachuteJ = pink
- For all J in {A, B, C, D}: ParachuteJ = blue -> KartJ ≠ fast
  (or KartC ≠ fast or KartC = basic)
- KartD ≠ fast (or KartD = basic)
- ParachuteC = blue

Ashley, Brenda, Cole, and Dylan are having a fun afternoon together at Cole's house and decide to play Mario Kart. This version of the game needs the player to unlock every new kart and customization, but unfortunately Cole has purchased it quite recently and only has very few items. The guys do not want to use the same pilot, so they have to choose one among Mario, Luigi, Bowser and Peach. Also, Brenda hates Bowser and Ashley does not want to be Peach. They all also need a kart and a parachute, the karts available are only the basic model, which is easy to drive but is not that fast, and the fast model, that has the opposite characteristics, so it is not for beginners. The unlocked parachutes are 5, so everyone will choose a different one. There is a pink one, that has to be used by whoever picks Peach as their character, an orange one, that requires as much skill as the fast kart to use, a blue one that cannot go with a fast kart, a yellow one, and a white one. Keep in mind that this will be Dylan's first time playing this game, so he cannot choose anything that requires expertise, while everyone else has already played, and that Cole's favorite color is blue, so he wants the blue parachute.

Model the problem as a CSP using the 4 pilots, the 4 karts and the 4 parachutes as variables and then show a possible solution where all the variables have an assigned value according to the existing constraints.

Possible solution:

PilotA = Mario, PilotB = Peach, PilotC = Bowser, PilotD = Luigi

KartA = fast, KartB = fast, KartC = basic, KartD = basic

ParachuteA = orange, ParachuteB = pink, ParachuteC = blue,
ParachuteD = white

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

Alice, Brenda and Clara want to take 3 different things so they can share and taste a bit of everything. Diana is vegan. Elisa and Fiona are still sweaty from the game so do not want to eat tortellini. Giselle and Hannah want to try Pina's famous tagliatelle. Ivanna, Jane, Kate and Laura are willing to take Pina's suggestion.

Model the problem as a CSP, using the volleyball players as variables and the different foods as values. Can Pina satisfy all the requests the girls made? If so, show a possible solution. If Jane, Kate and Laura hear the idea of sharing 3 different types of food and want to do it too, would Pina still be able to satisfy all the requests? Motivate your answer.

Variables:

- A, B, C, D, E ,F, G, H, I, J, K ,L in {lasagna, tortellini, tagliatelle, erbazzone}

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

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Constraints:

- AllDifferent(A, B, C)

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

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Constraints:

- AllDifferent(A, B, C)
- D = erbazzone

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

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Model the problem as a CSP, using the volleyball players as variables and the different foods as values. Can Pina satisfy all the requests the girls made? If so, show a possible solution. If Jane, Kate and Laura hear the idea of sharing 3 different types of food and want to do it too, would Pina still be able to satisfy all the requests? Motivate your answer.

Constraints:

- AllDifferent(A, B, C)
- D = erbazzone
- E ≠ tortellini
- F ≠ tortellini

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

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Constraints:

- AllDifferent(A, B, C)
- D = erbazzone
- E ≠ tortellini
- F ≠ tortellini
- G = tagliatelle
- H = tagliatelle

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

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Possible solution:

A = Erbazzone; B = Lasagna; C = Tortellini; D = Erbazzone; E = Lasagna;

F = Erbazzone; G = Tagliatelle; H = Tagliatelle; I = Tortellini;

J = Tagliatelle ; K = Lasagna; L = Tortellini.

A volleyball team of 12 people has just finished the last game of the season and is now heading to Grandma Pina's restaurant. Unfortunately for her, it is already 10:30 in the evening, so most of the food has already been eaten by other guests. Pina still has 3 servings of lasagna, 4 of tortellini (only in broth), 3 of tagliatelle, 3 erbazzone (the only meal that is ok for vegans).

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Model the problem as a CSP, using the volleyball players as variables and the different foods as values. Can Pina satisfy all the requests the girls made? If so, show a possible solution. If Jane, Kate and Laura hear the idea of sharing 3 different types of food and want to do it too, would Pina still be able to satisfy all the requests? Motivate your answer.

Second question:

If Jane, Kate and Laura want 3 different meals, it will still be possible for Pina to satisfy their request because there are 13 meals total and the other constraints do not lock all the servings of more than 1 meal, see solution above.