

Algorithmic Thinking for Migrants Teachers Education

2021-1-EL01-KA210-ADU-000035033

Handout #4: Patterns & Generalization

EXERCISE #1

Update the drawing of the smiley face discussed earlier in the chapter so that the positioning of the features (eyes and mouth) are calculated automatically based on the positioning of the face.

- A. 'Draw face' is a subroutine (r, x, y):
- Draw circle with radius r at position x, y filled yellow
 - Call 'draw eye' with parameters $r1 = 0.25 \times r$, $r2 = 0.125 \times r$, $x = x - 0.5 \times r$, $y = y - 0.5 \times r$
 - Call 'draw eye' with parameters $r1 = 0.25 \times r$, $r2 = 0.125 \times r$, $x = x + 0.5 \times r$, $y = y - 0.5 \times r$
 - Call 'draw mouth' with parameters $x1 = x - 0.5 \times r$, $y1 = y + 0.5 \times r$, $x2 = x + 0.5 \times r$, $y2 = y + 0.5 \times r$

EXERCISE #2

Further update the drawing of the smiley face.

A.

- 'Draw face' is a subroutine (r, x, y):

Draw circle with radius r at position x, y filled yellow



ii. 'Draw mouth' is a subroutine (x_1, y_1, x_2, y_2):

Draw line from x_1, y_1 to x_2, y_2 coloured red

iii. "Draw eye' is a subroutine (r_1, r_2, x, y):

Draw circle with radius r_1 at position x, y

Draw circle with radius r_2 at position x, y filled brown

B. 'Draw scar' is a subroutine (x, y):

Draw line from x, y to $x, y+10$

Draw line from $x-2, y+2$ to $x+2, y+2$

Draw line from $x-2, y+4$ to $x+2, y+4$

Draw line from $x-2, y+6$ to $x+2, y+6$

Draw line from $x-2, y+8$ to $x+2, y+8$

C. 'Draw nose' is a subroutine (r, x, y):

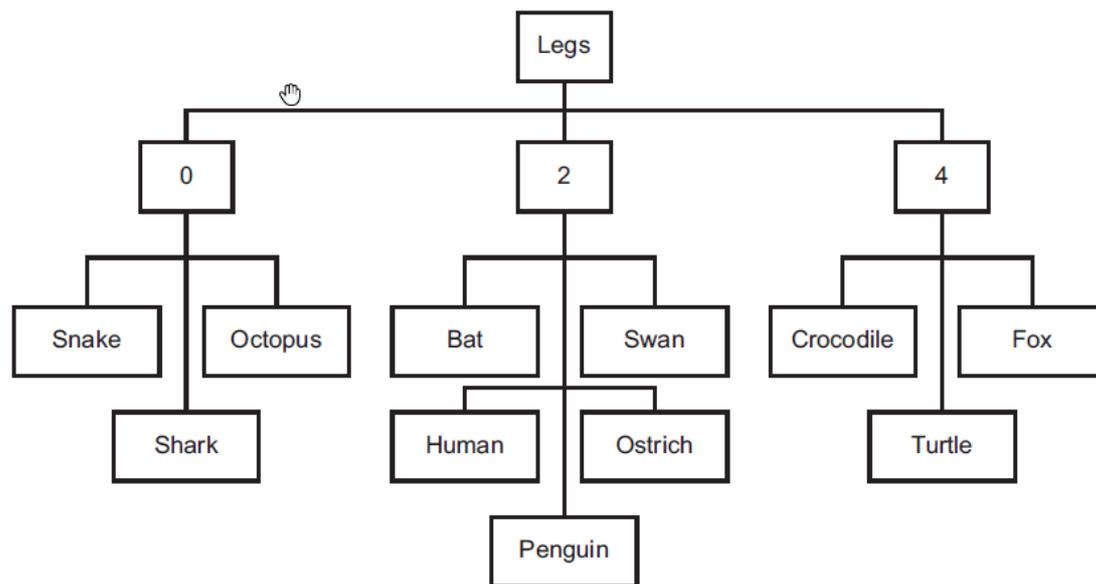
Draw circle with radius r at position x, y filled red

Drawing the nose must be done after drawing the face and eyes for it to appear above them.

EXERCISE #3

Use your tree structures to guide your questioning strategy. Which one of the three structures would minimize the number of questions you would have to ask? Try dividing groupings into sub-groupings to see if that helps to reduce the number of questions.

Species organized into a tree structure by number of legs



The tree helps to show the maximum number of questions you would have to ask when following each strategy. For example, when following the 'number of legs' strategy, the maximum numbers of questions you would ask is eight:

- A. Does it have no legs? No.
- B. Does it have 4 legs? No.
- C. Does it have 2 legs? Yes.
- D. Is it a bat? No.
- E. Is it a human? No.
- F. Is it a penguin? No.
- G. Is it an ostrich? No.
- H. Is it a swan? Yes.



Compare this to the other strategies.

The ‘does it fly?’ strategy is potentially good because the tree is very unbalanced – you could eliminate a huge number of animals if the answer to ‘Does it fly?’ is ‘yes’. However, this is also its weakness. If the answer is ‘no’, you could potentially have to ask eight more questions, meaning the maximum number of questions for this strategy is nine.

The ‘species’ strategy provides a balanced and shallow tree. The maximum number of questions you would have to ask is seven.