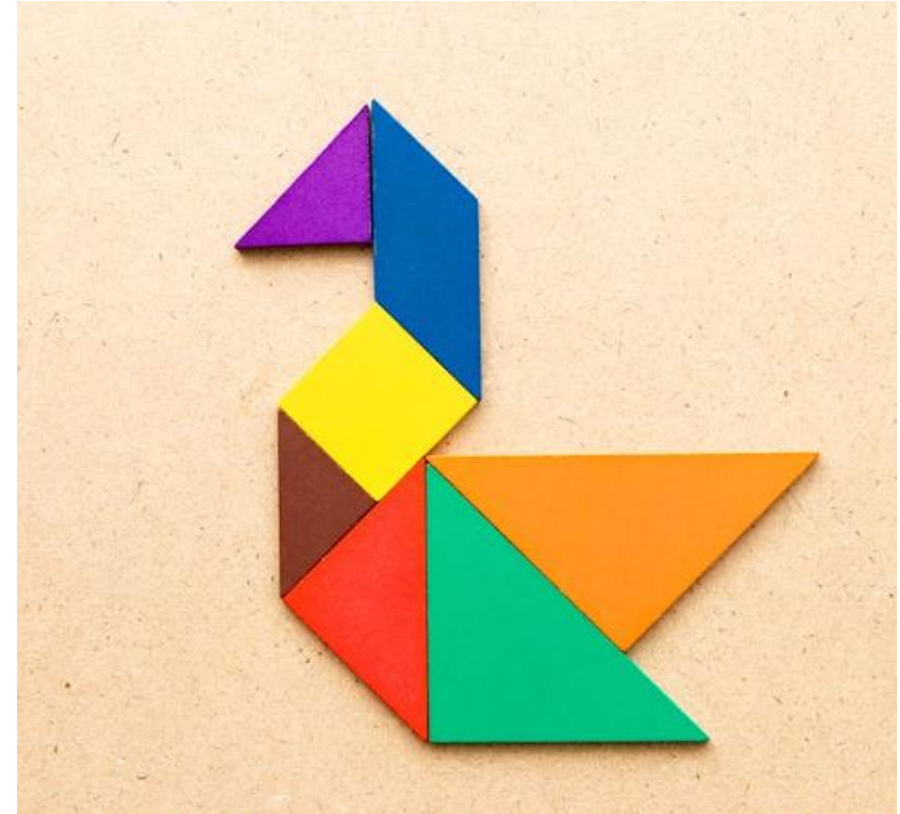


Detour: TangraM

- ▶ Just like in the classic tangram puzzle, where simple shapes are assembled to form complex designs, we can construct TMs by **assembling smaller TMs**
- ▶ For instance, we want machine M' to invoke **subroutine A** if condition X is satisfied and invoke **subroutine B** otherwise
- ▶ The goal is to carefully construct these subroutines so that M' **has the desired key property** for the Turing reduction



Tangram Example

- ▶ Desired key property:
 - ▶ Condition $X = \text{true} \Rightarrow M'$ accepts all inputs
 - ▶ Condition $X = \text{false} \Rightarrow M'$ does not accept all inputs
- ▶ Find combinations of the subroutines M' should call in each block to realize the key property above

function $M'(w)$:

if Condition $X = \text{true}$ then:

else:

function $A(a)$:
accept

function $B(b)$:
reject

function $C(c)$:
loop

function $D(d)$:
if $d = \varepsilon$ then accept
else reject

function $E(e)$:
if $e \in \{3,7,6\}$ then loop
else reject

function $F(f)$:
if $1 = 0$ then reject
else accept

Tangram Exercise

- ▶ Desired key property:
 - ▶ Condition $X = \text{true} \Rightarrow M'$ accepts finite number of inputs
 - ▶ Condition $X = \text{false} \Rightarrow M'$ accepts infinite number of inputs
- ▶ Find combinations of the subroutines M' should call in each block to realize the key property above

function $M'(w)$:

if Condition $X = \text{true}$ then:

else:

function $A(a)$:
accept

function $B(b)$:
reject

function $C(c)$:
loop

function $D(d)$:
if $d = \varepsilon$ then accept
else reject

function $E(e)$:
if $e \in \{3,7,6\}$ then loop
else reject

function $F(f)$:
if $1 = 0$ then reject
else accept