



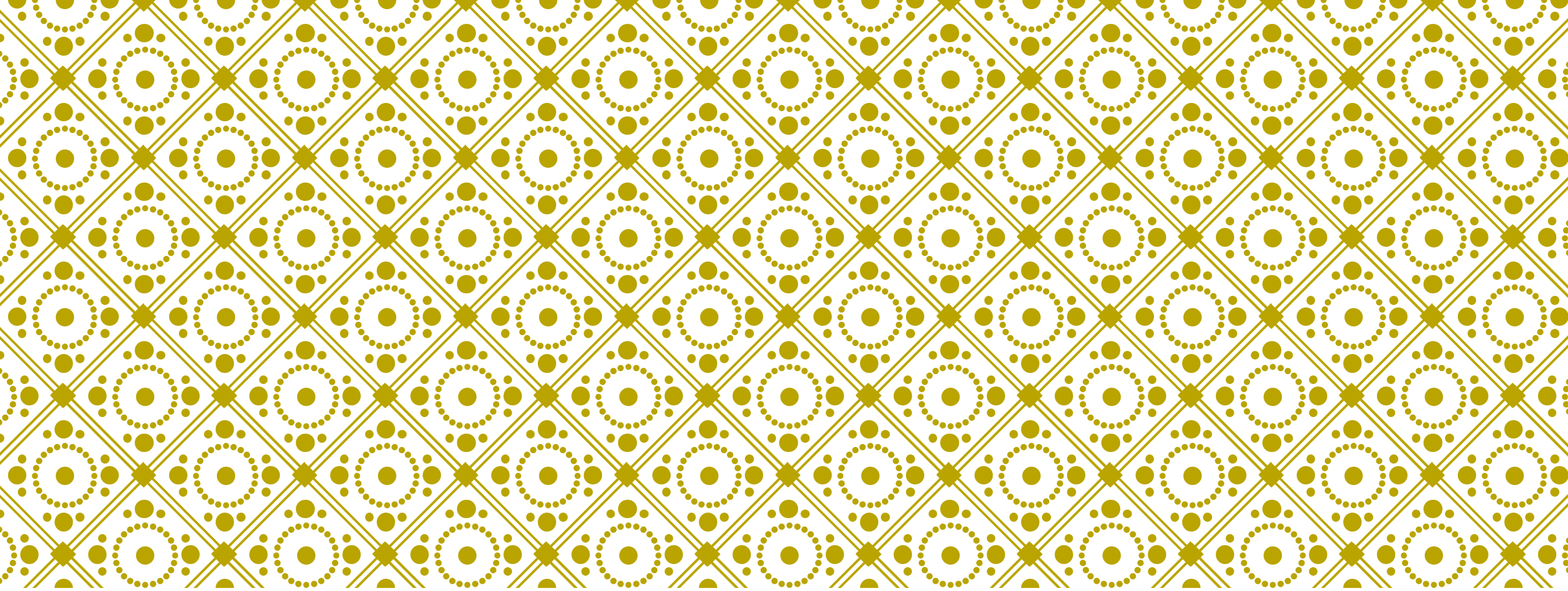
MEMORY NETWORKS (WESTON ET AL. 2014)

Chase Stevens



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2. Conceptual overview
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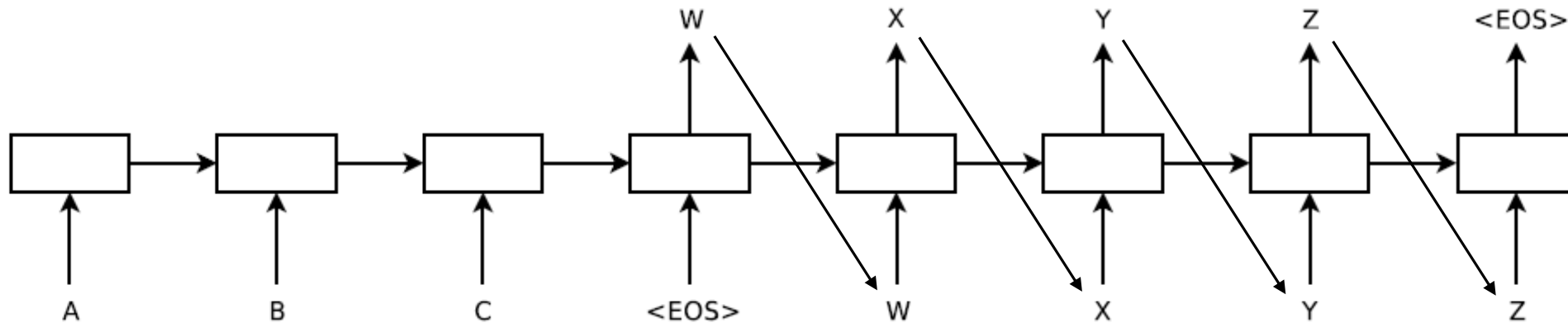
MOTIVATION |



PROBLEM:

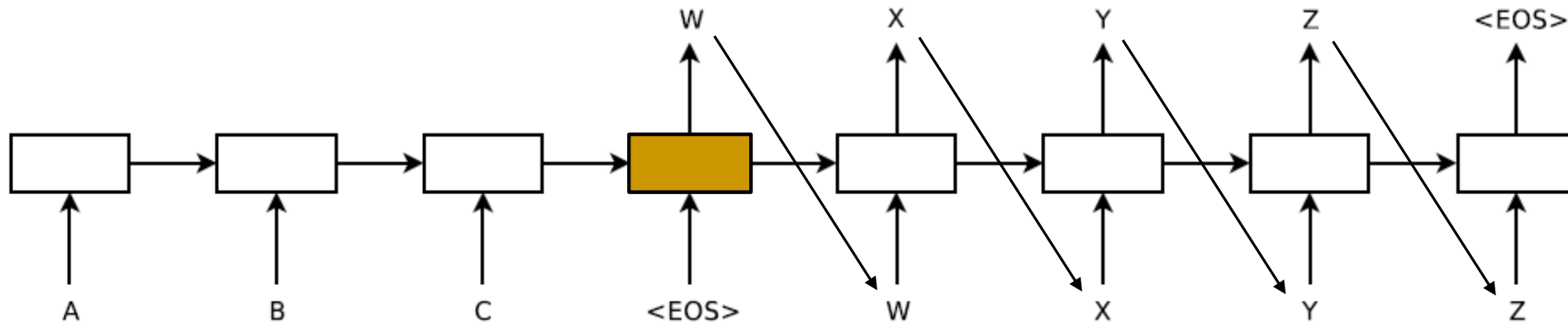
How to perform question answering on large sequences?

RECURRENT NEURAL NETWORKS

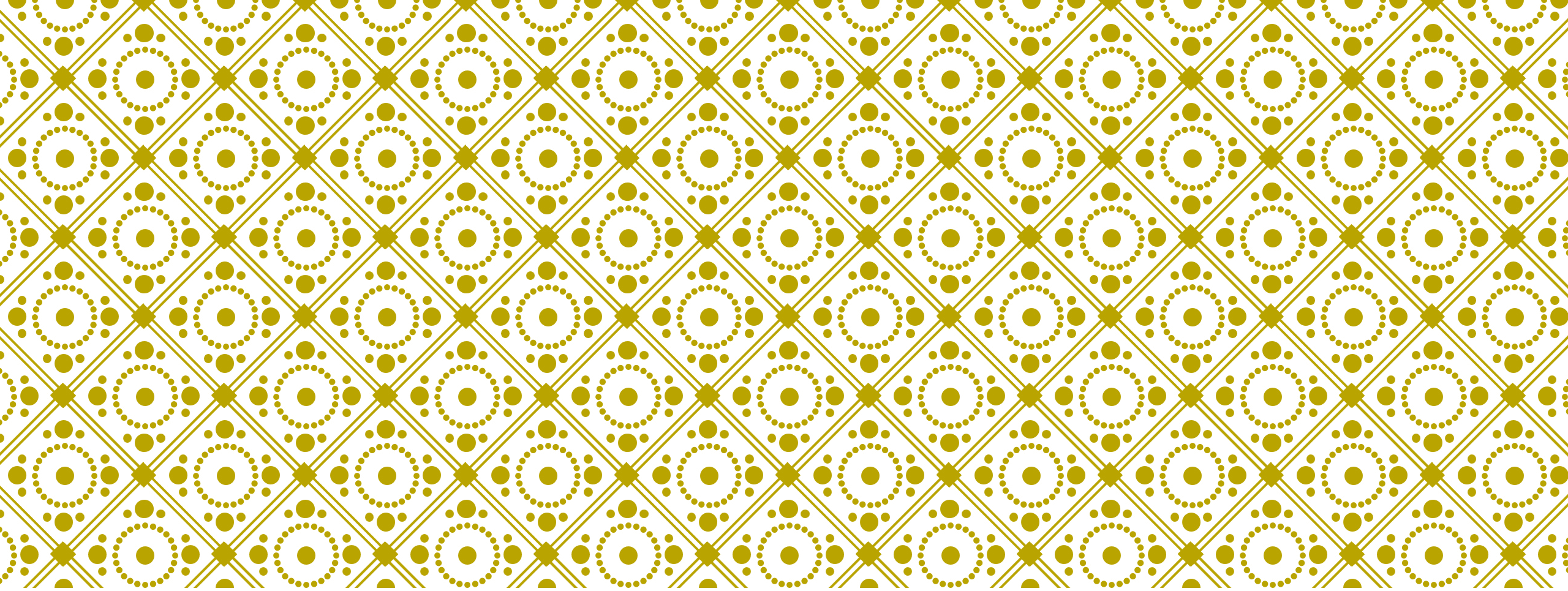


(modified from Sutskever et al. 2014 “Sequence to Sequence Learning with Neural Networks”)

RECURRENT NEURAL NETWORKS



(modified from Sutskever et al. 2014 “Sequence to Sequence Learning with Neural Networks”)

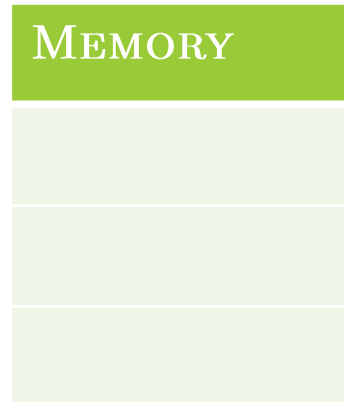


CONCEPTUAL OVERVIEW



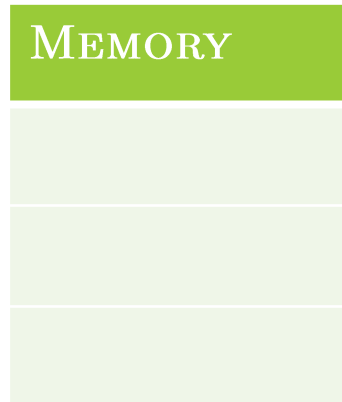
MEMORY NETWORK ARCHITECTURE

MEMORY NETWORK ARCHITECTURE



Memory (m)

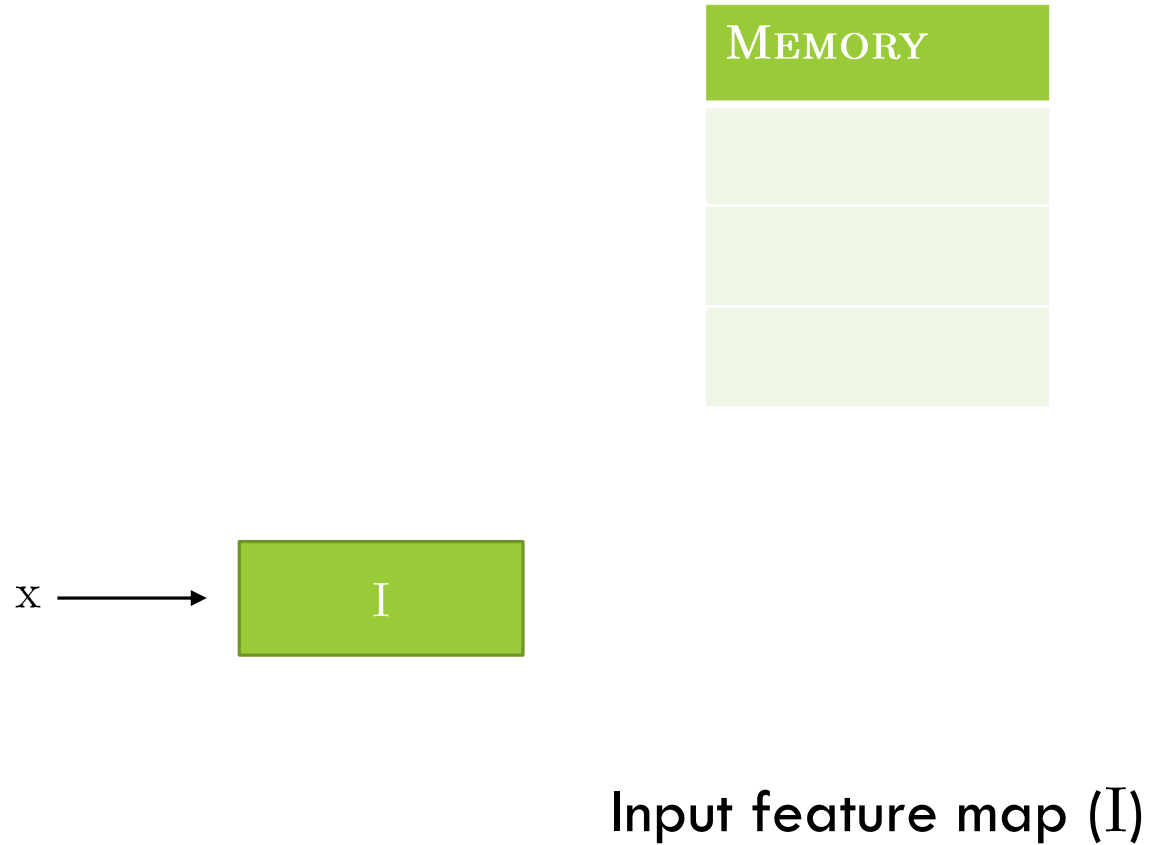
MEMORY NETWORK ARCHITECTURE



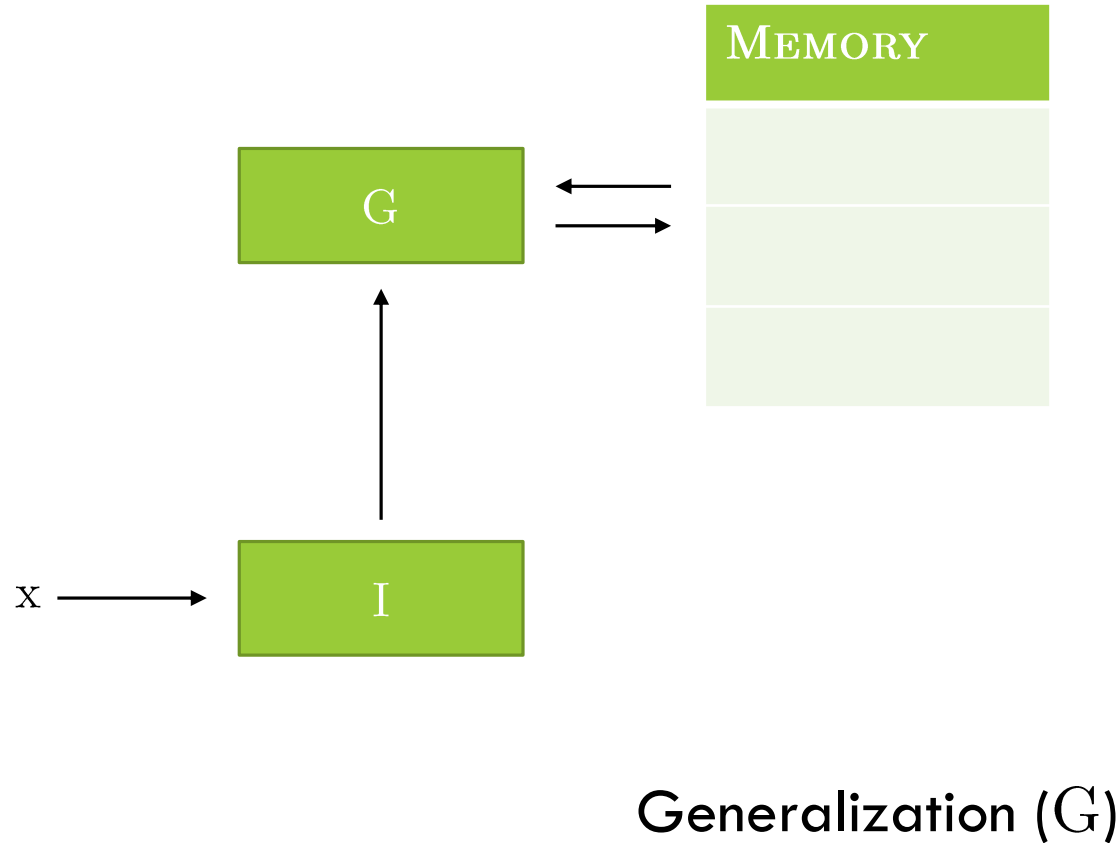
x

Input (x)

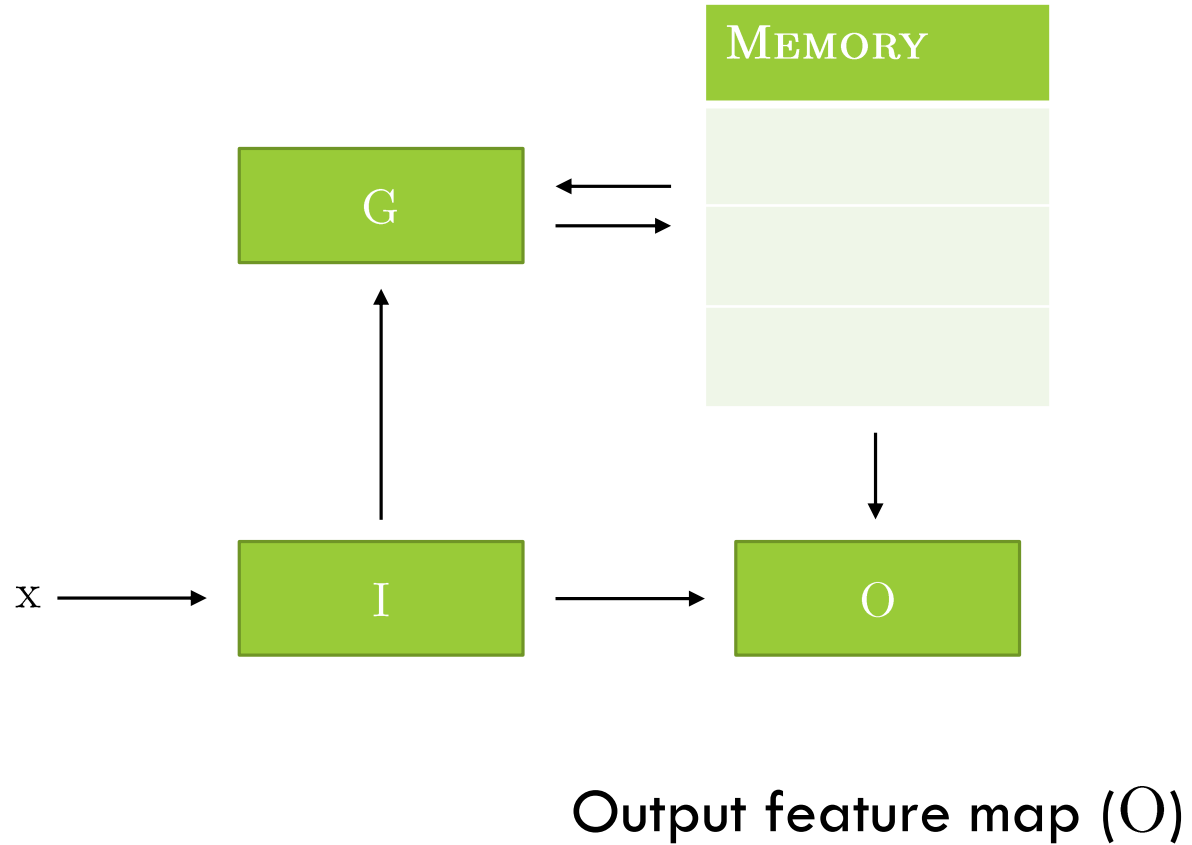
MEMORY NETWORK ARCHITECTURE



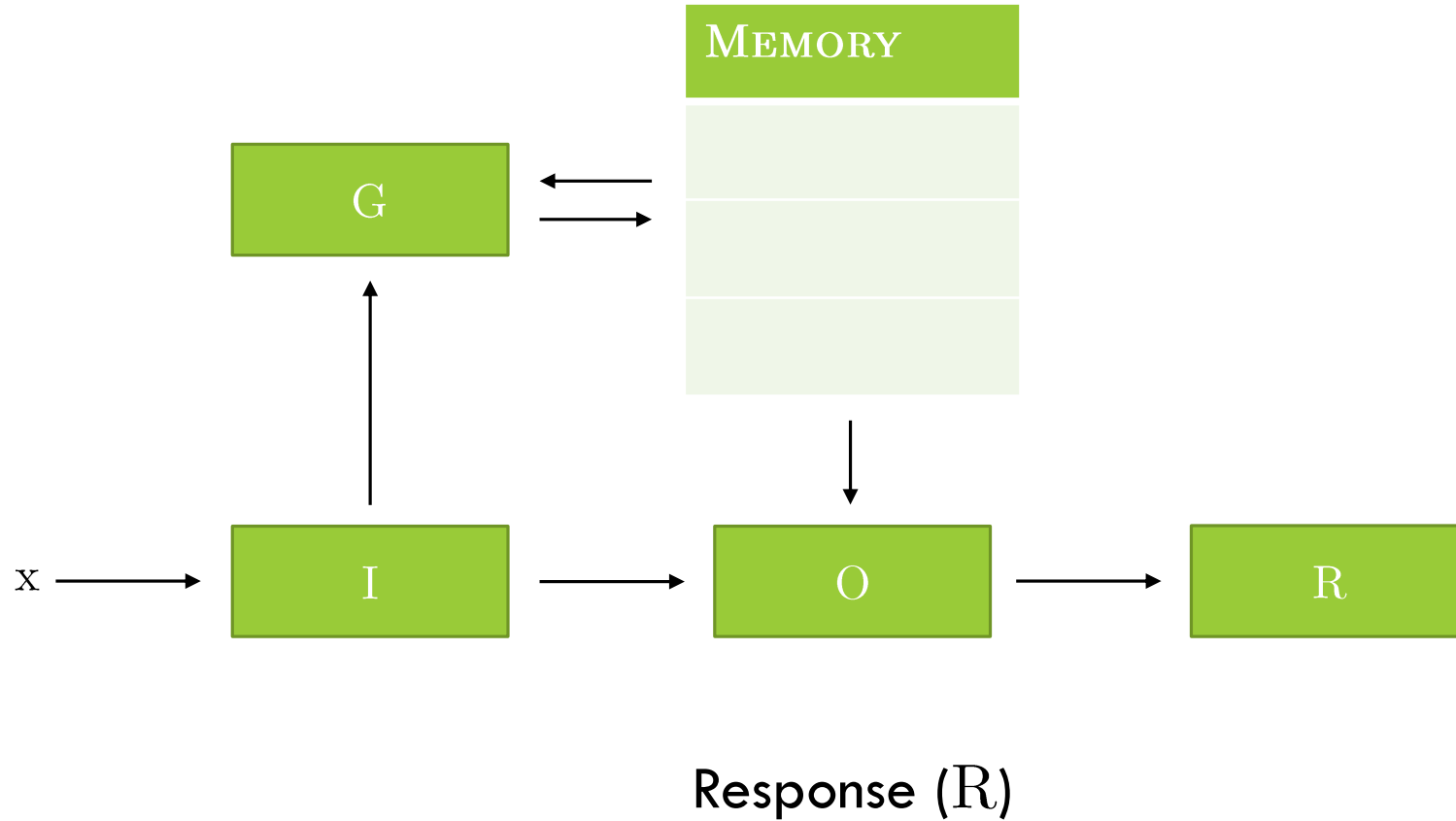
MEMORY NETWORK ARCHITECTURE



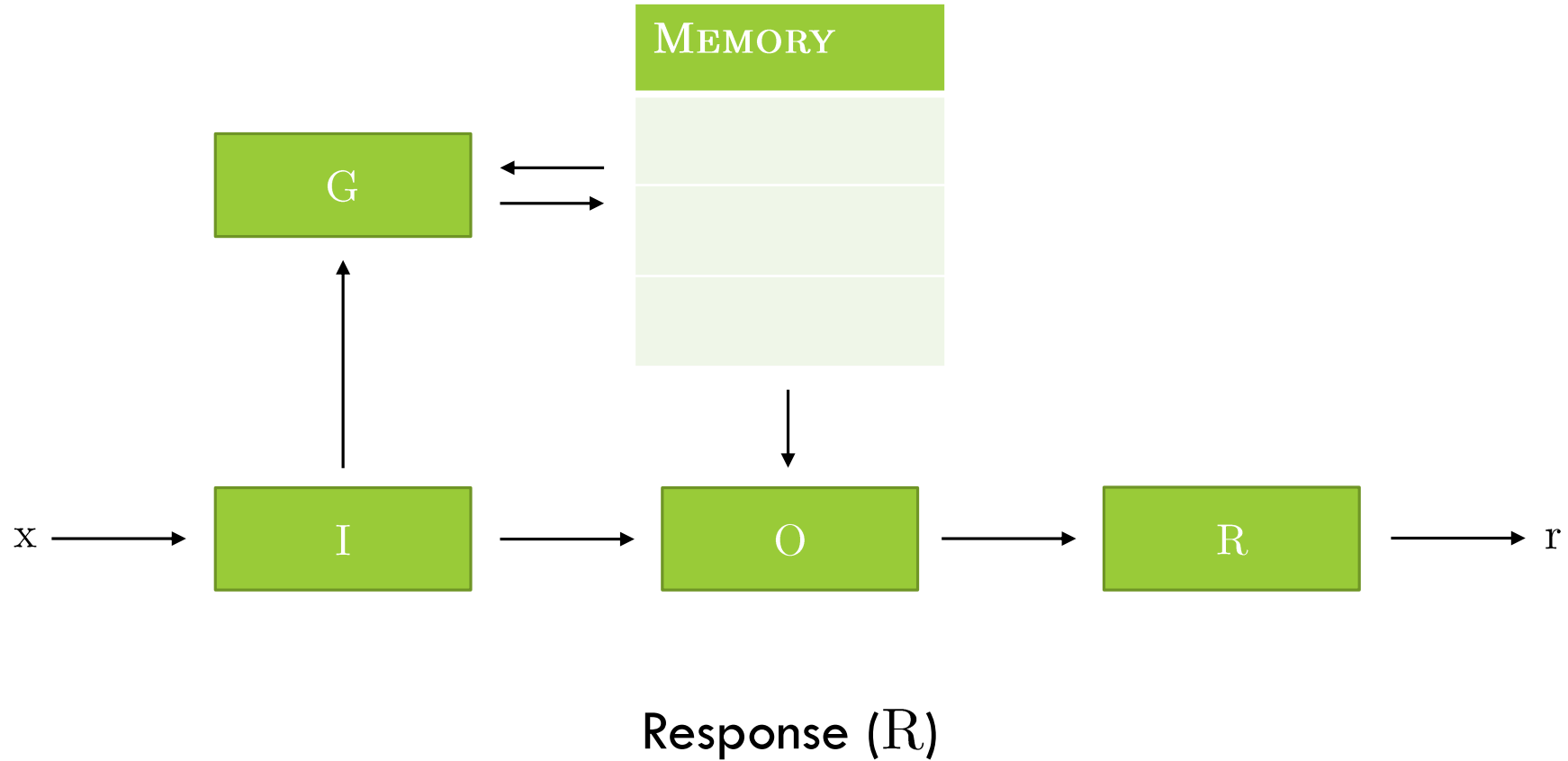
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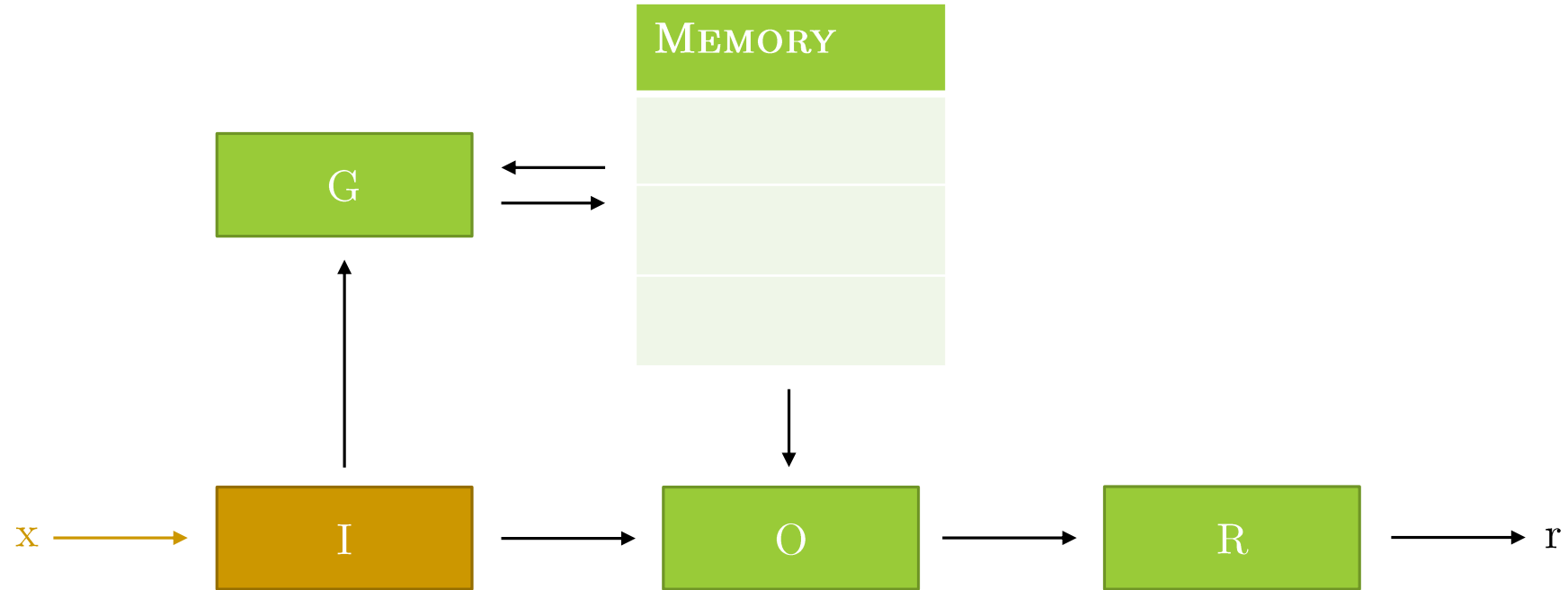
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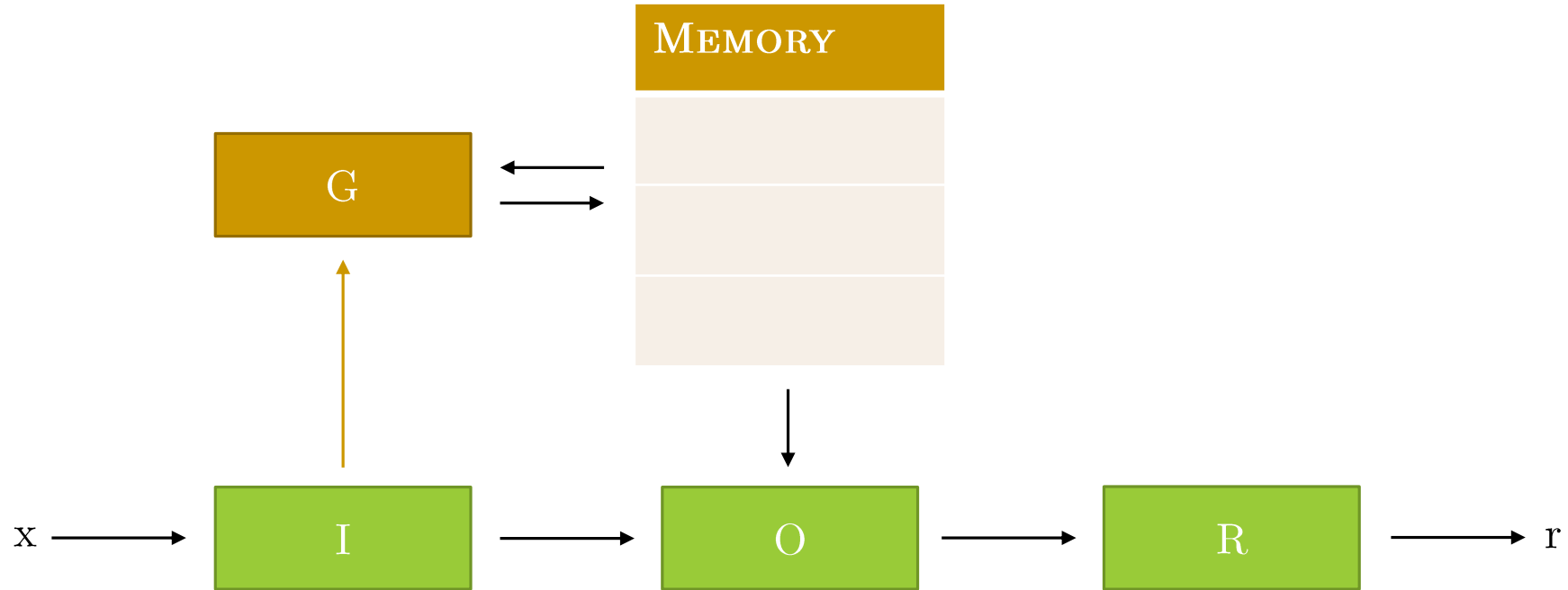
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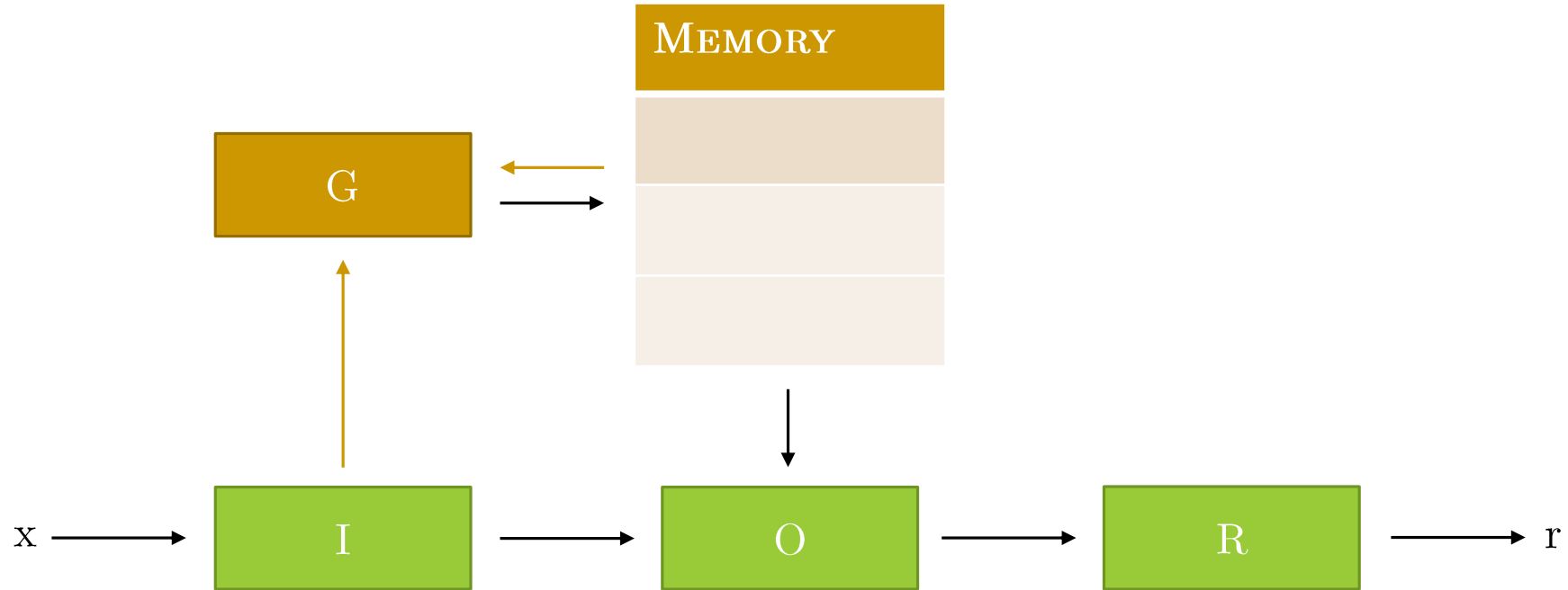
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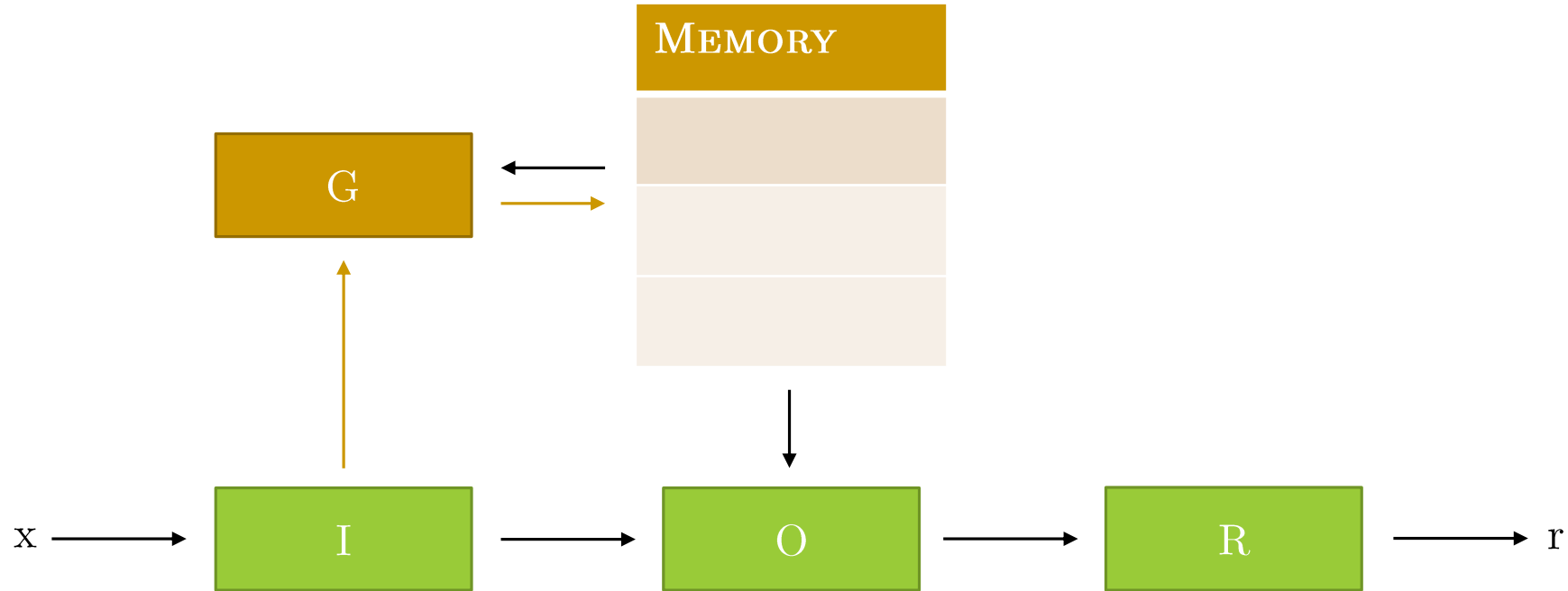
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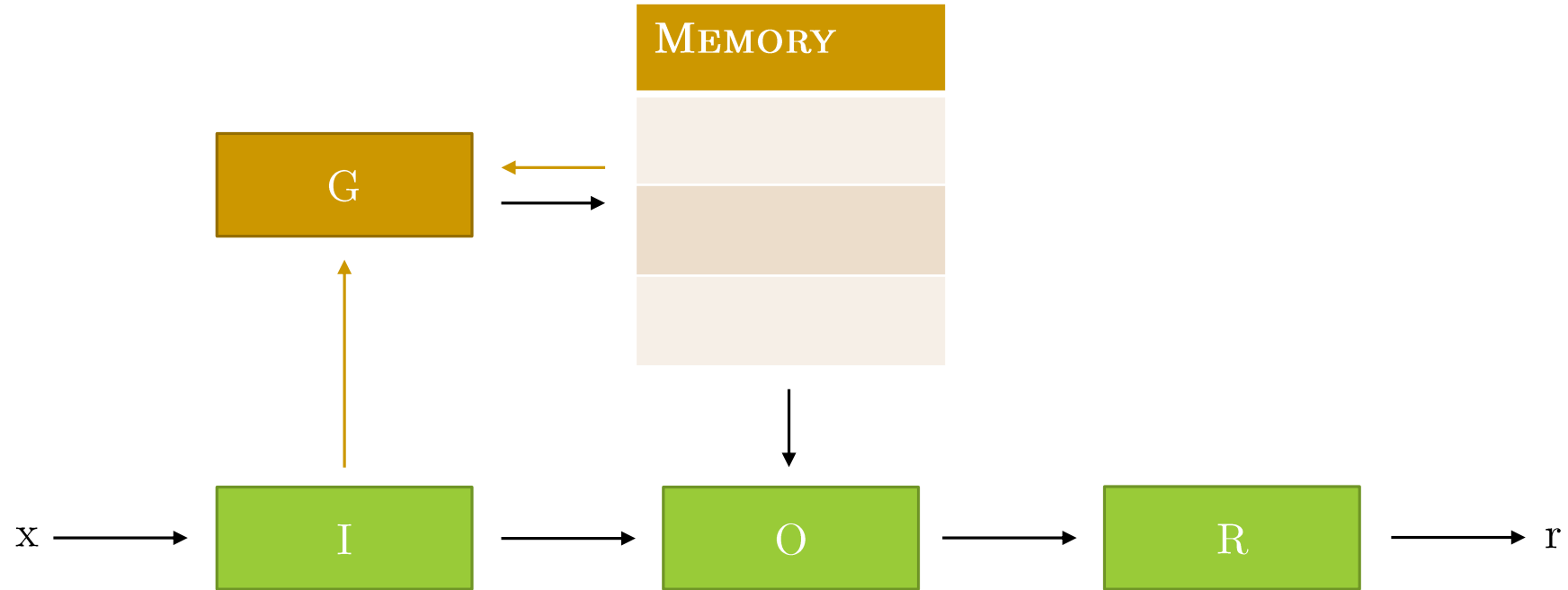
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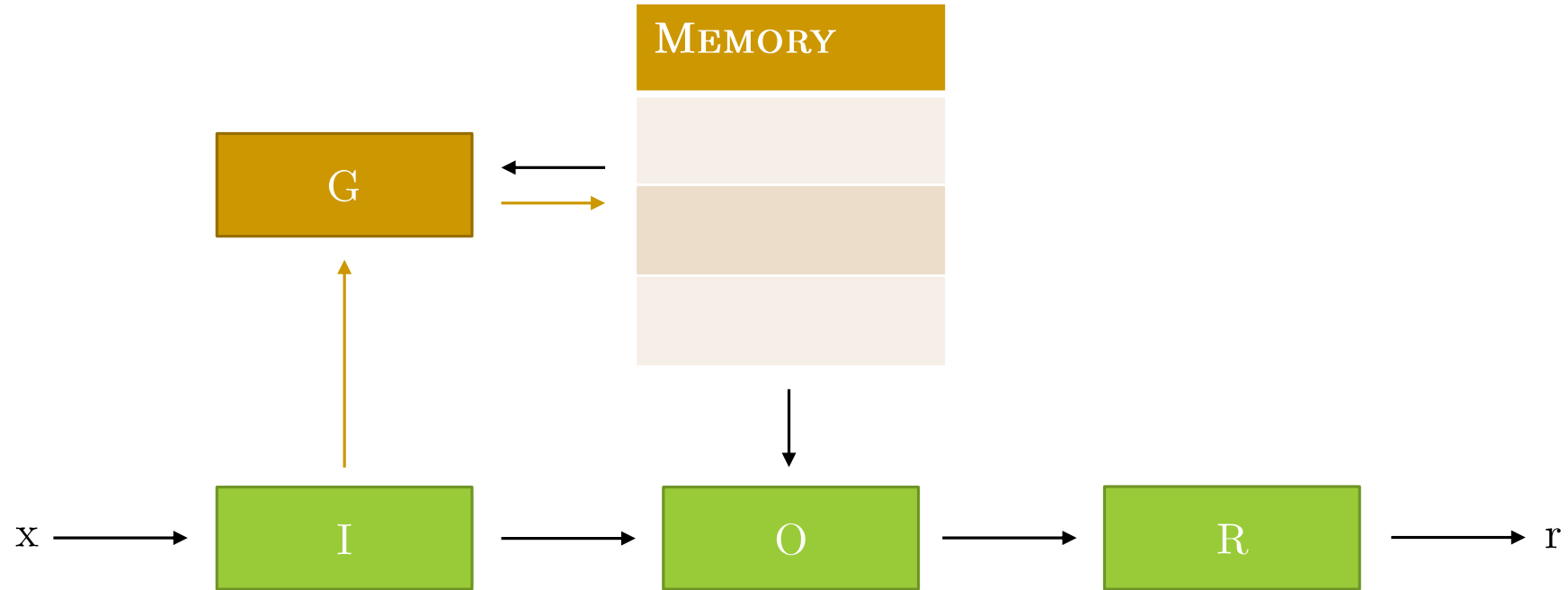
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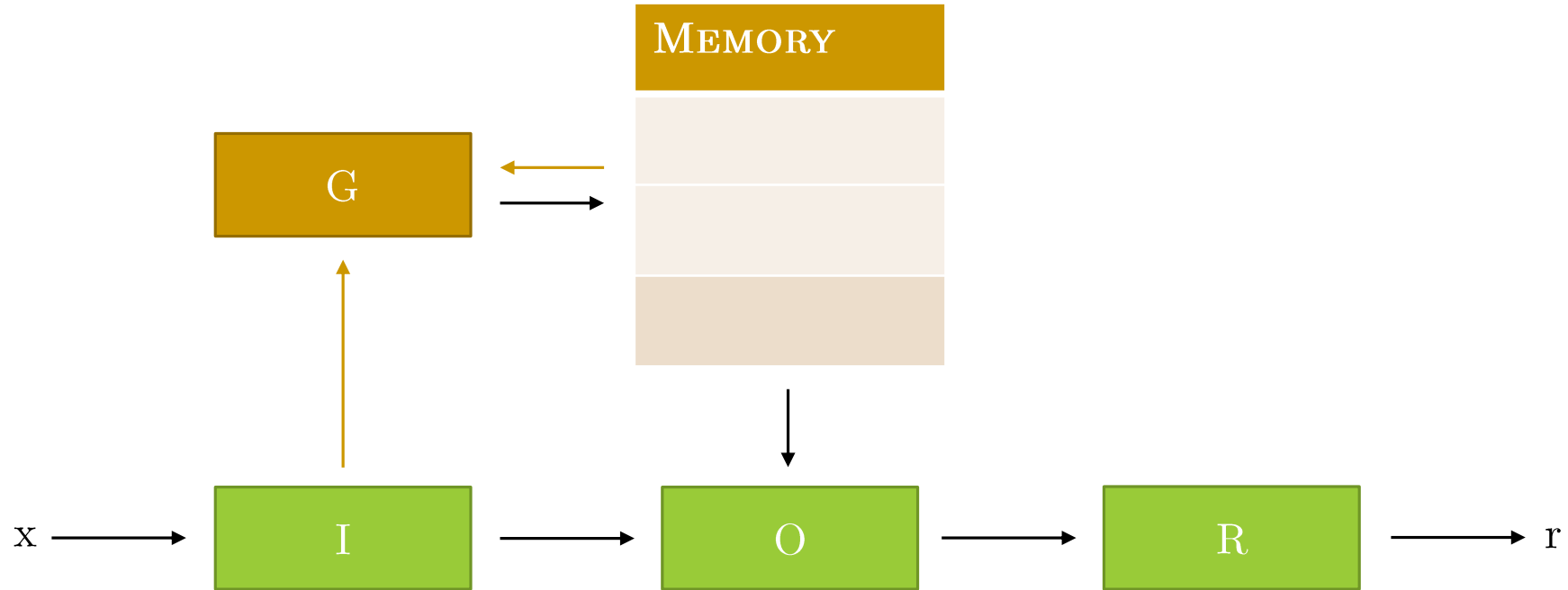
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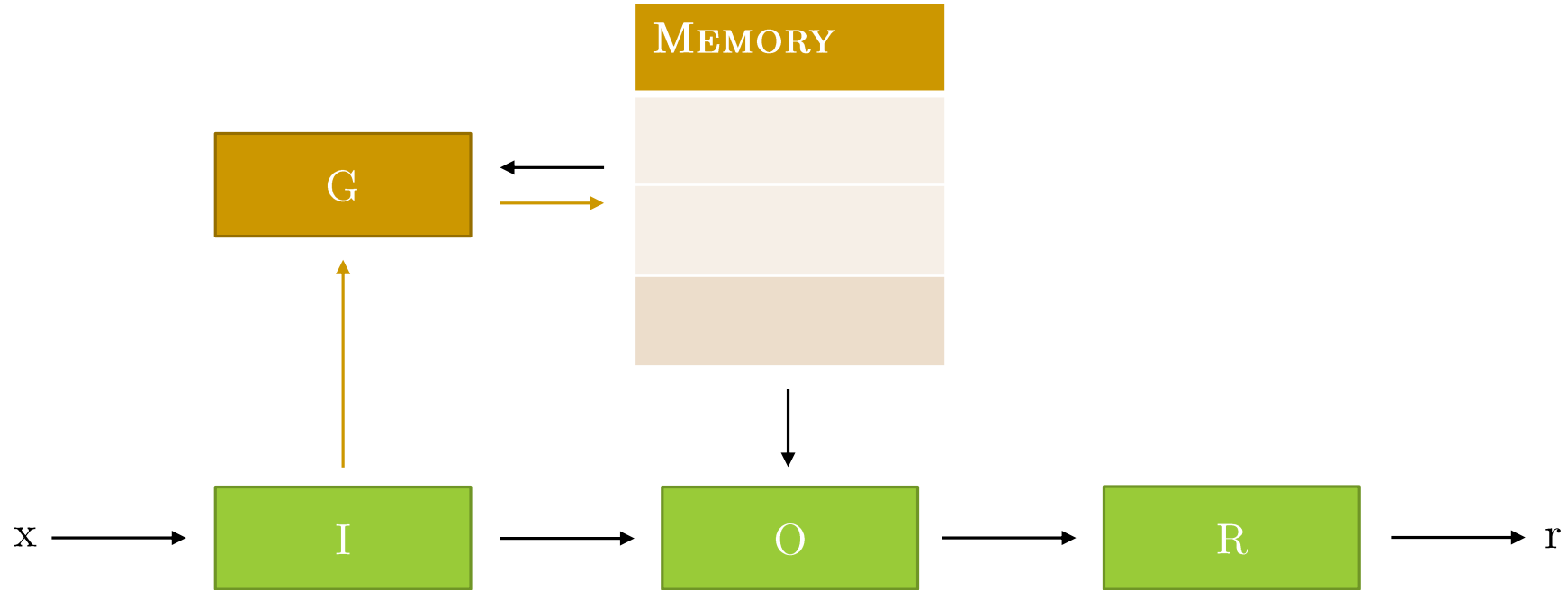
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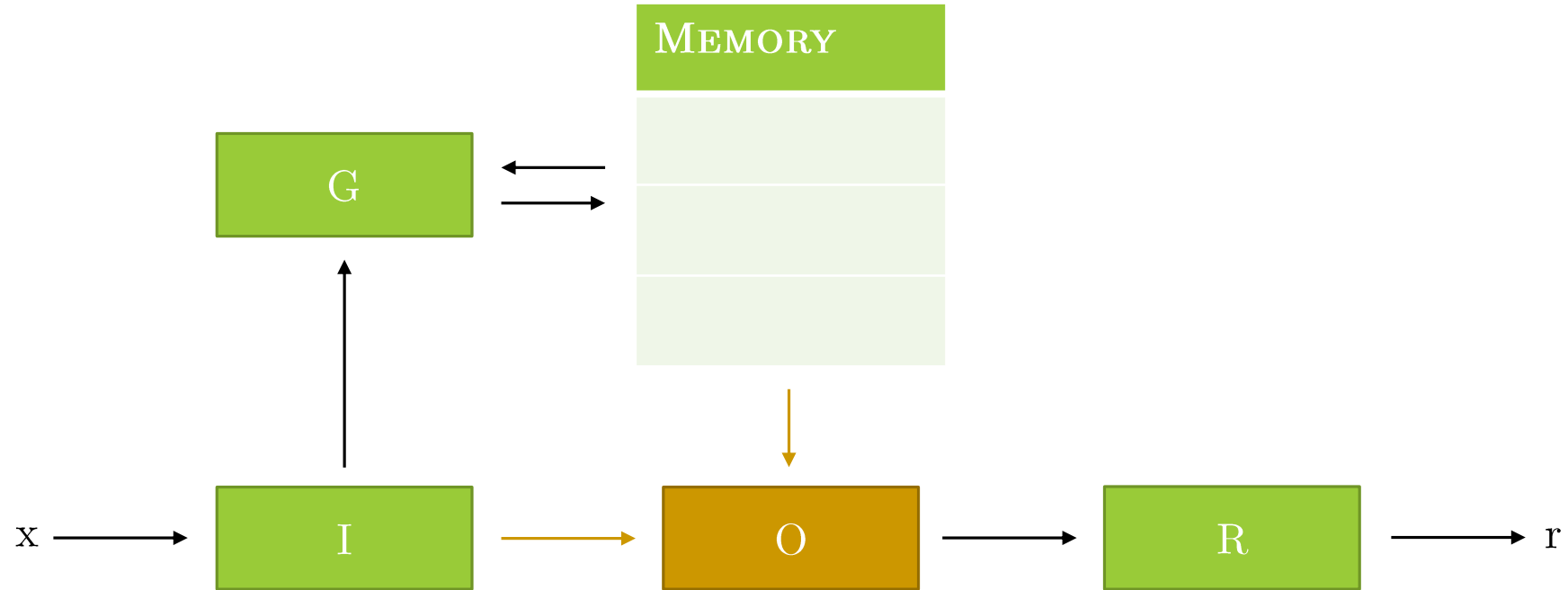
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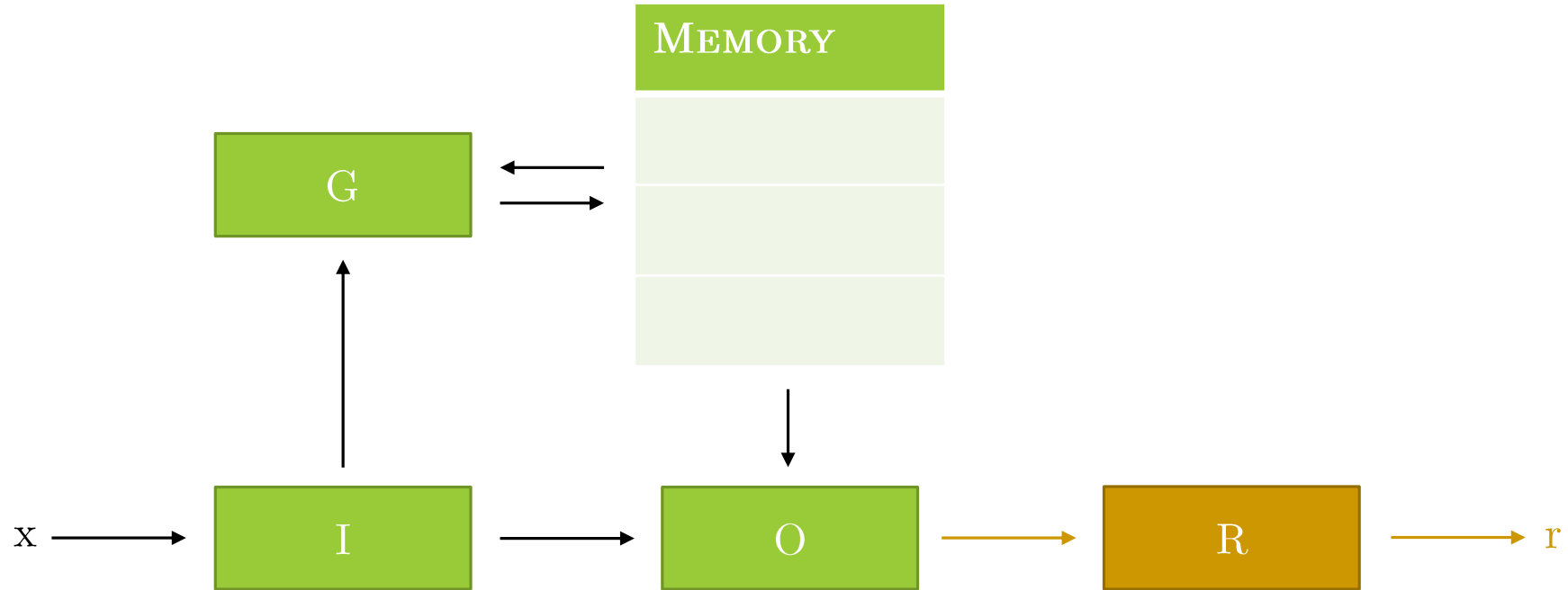
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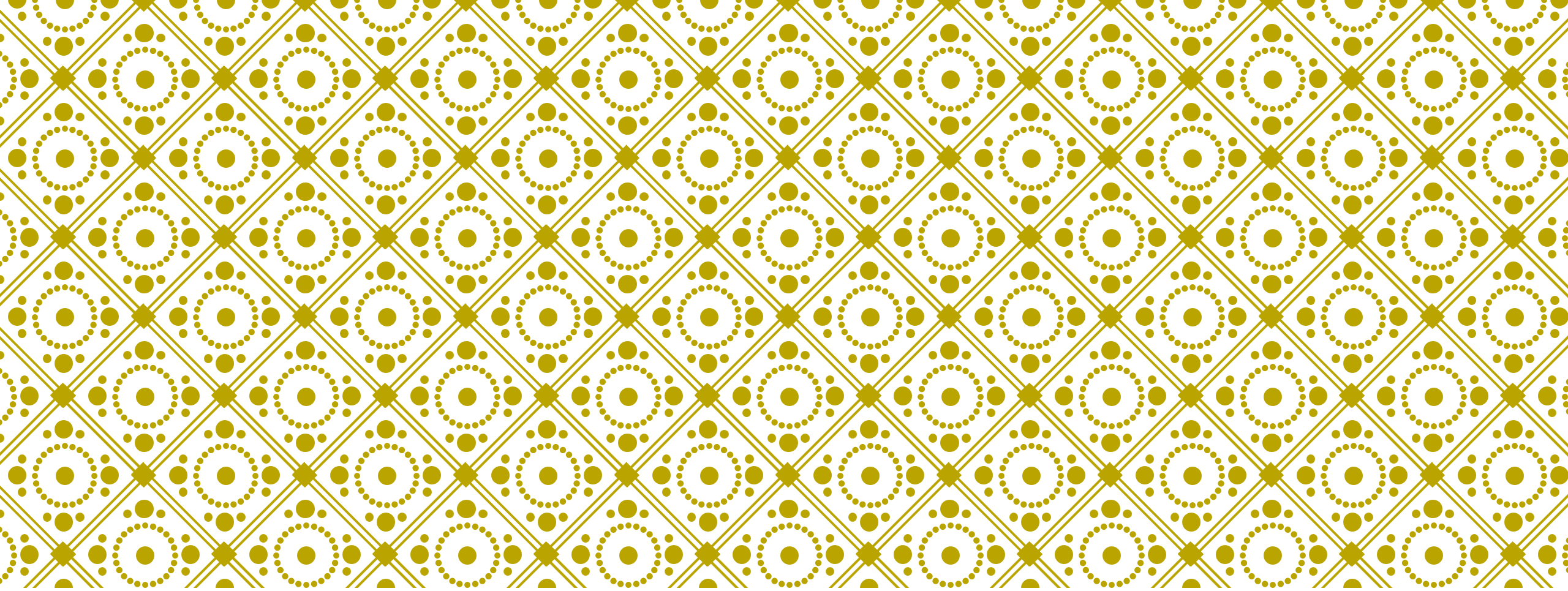


MEMORY NETWORK ARCHITECTURE



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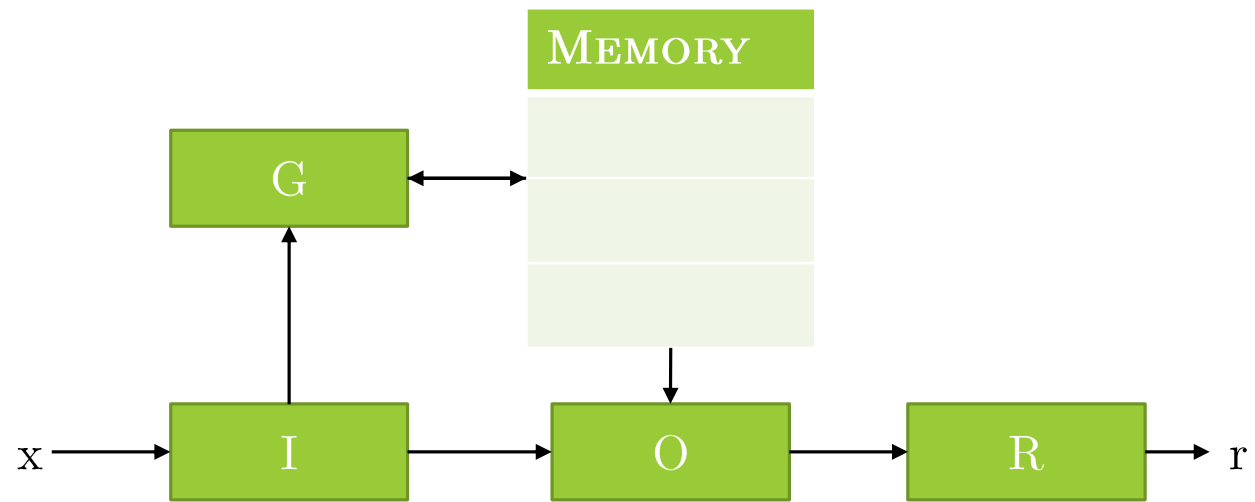




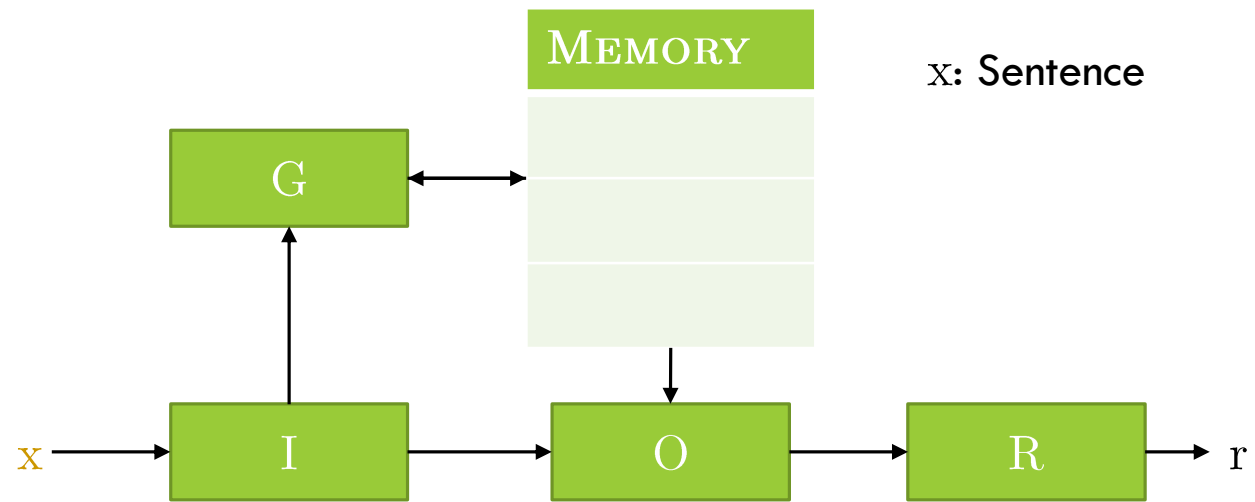
TASK-SPECIFIC IMPLEMENTATION



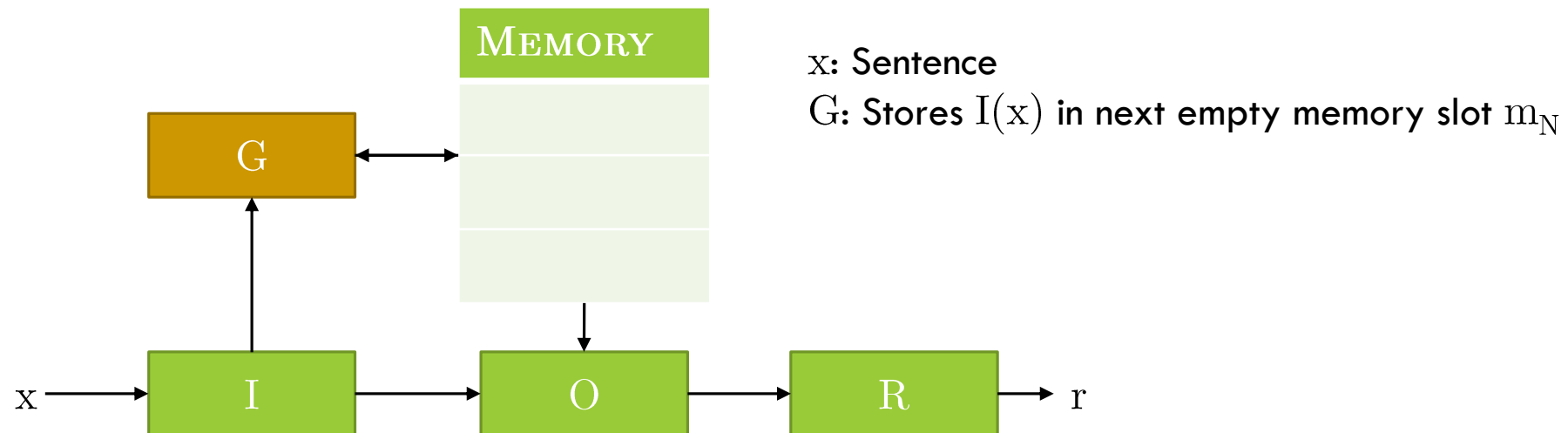
MEMORY NETWORK FOR TEXT



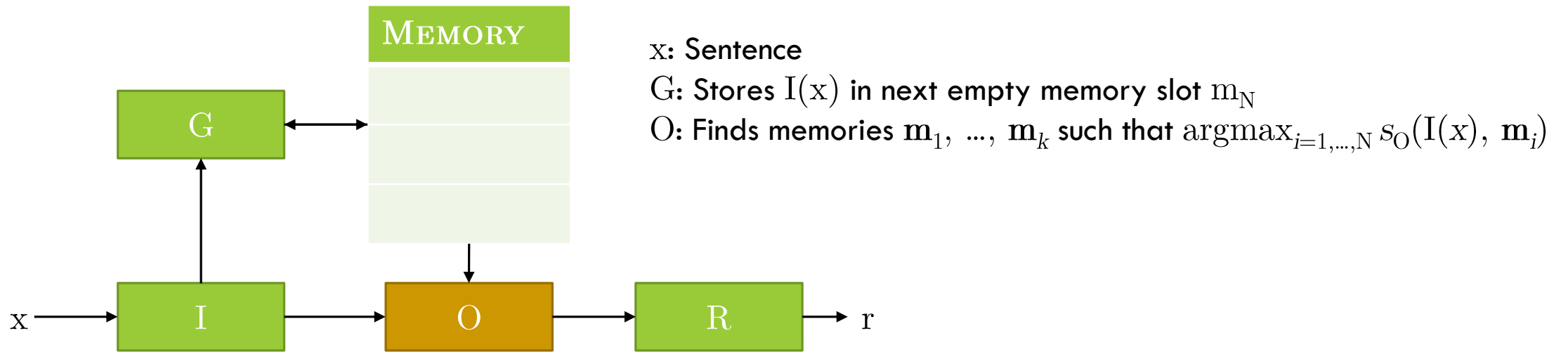
MEMORY NETWORK FOR TEXT



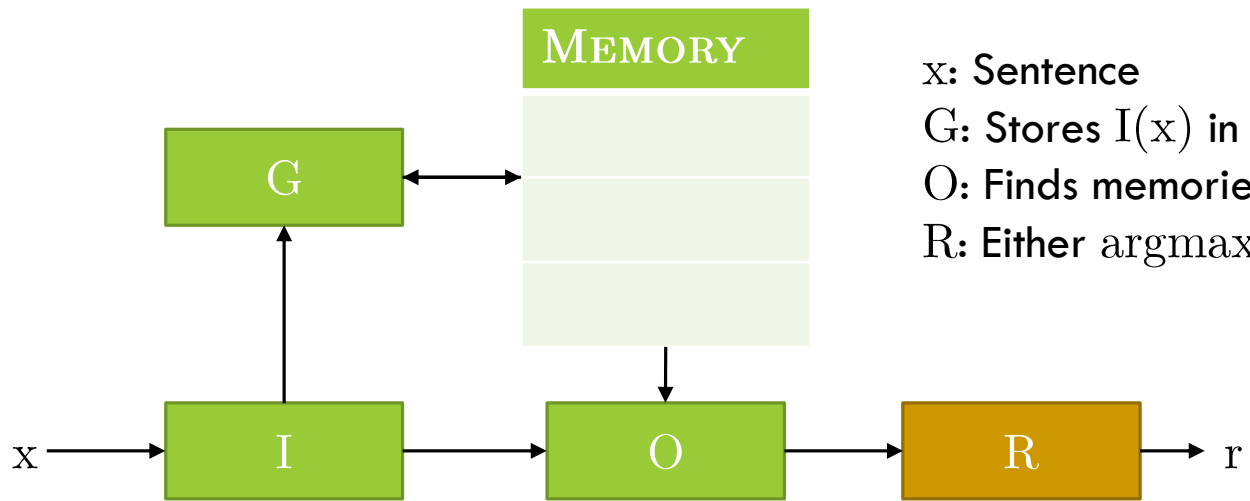
MEMORY NETWORK FOR TEXT



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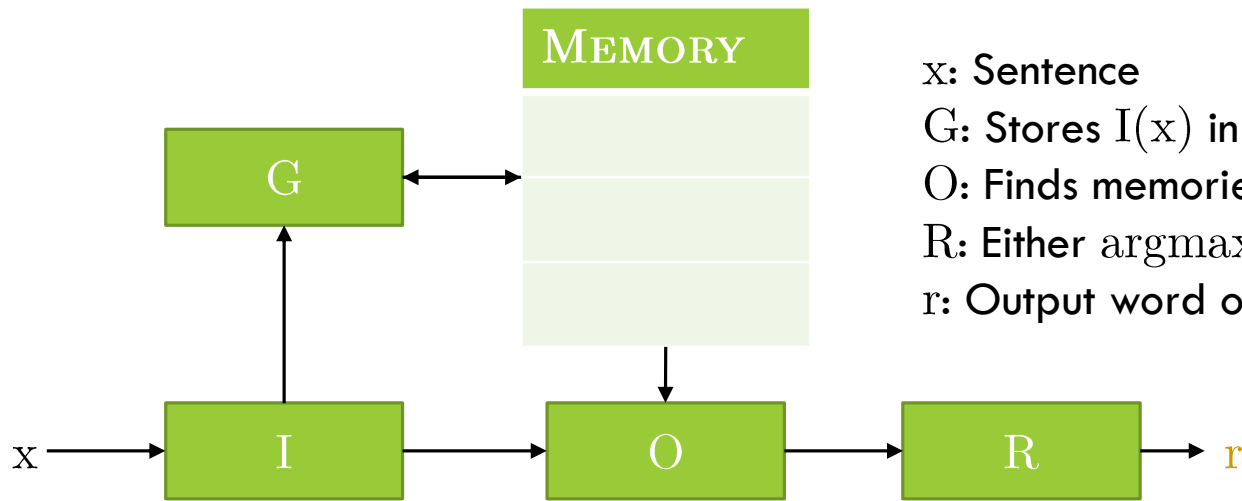
x : Sentence

G: Stores $I(x)$ in next empty memory slot m_N

O: Finds memories m_1, \dots, m_k such that $\operatorname{argmax}_{i=1, \dots, N} s_O(I(x), m_i)$

R: Either $\operatorname{argmax}_{w \in W} s_R([I(x), m_1, \dots, m_k], w)$ or an RNN

MEMORY NETWORK FOR TEXT



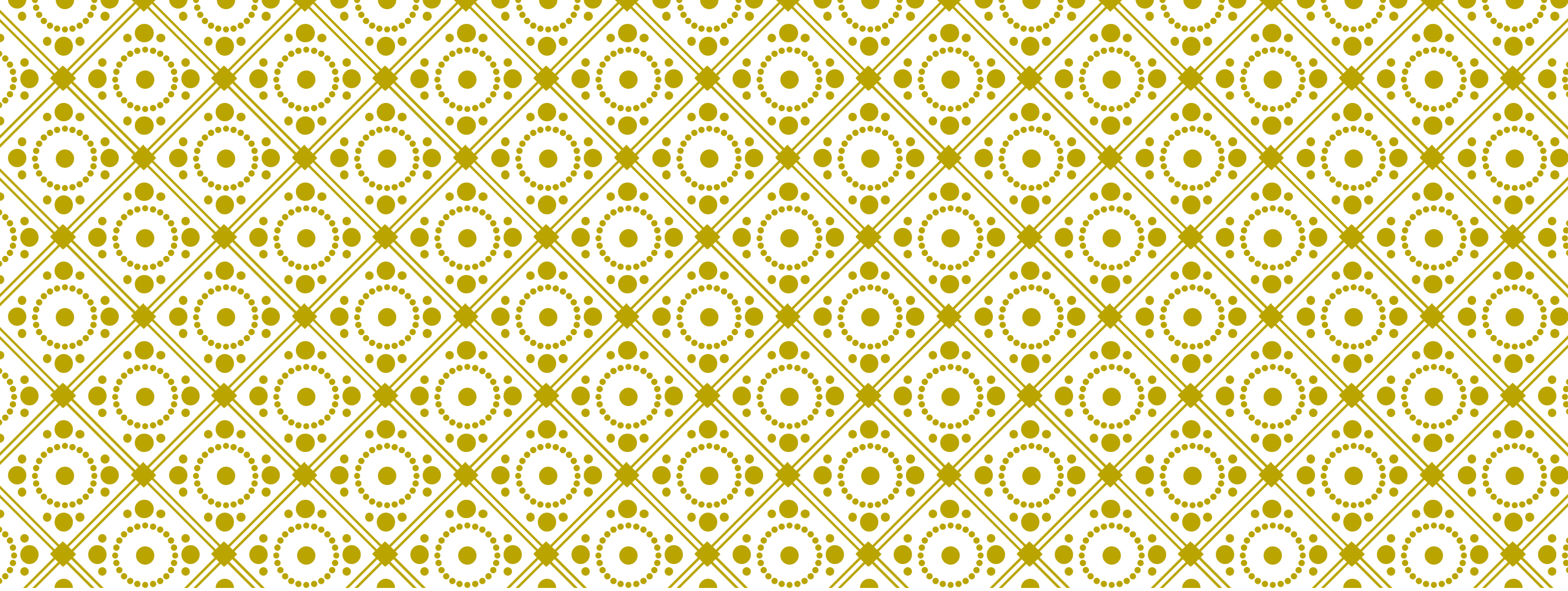
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r : Output word or word sequence



RESULTS





EXAMPLE OUTPUT

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Joe went to the kitchen.

Fred went to the kitchen.

Joe picked up the milk.

Joe travelled to the office.

Joe left the milk.

Joe went to the bathroom.

Where is the milk now? A: office

Where is Joe? A: bathroom

Where was Joe before the office? A: kitchen

EXAMPLE OUTPUT

Bilbo travelled to the cave.

Gollum dropped the ring there.

Bilbo took the ring.

Bilbo went back to the Shire.

Bilbo left the ring there.

Frodo got the ring.

Frodo journeyed to Mount-Doom.

Frodo dropped the ring there.

Sauron died.

Frodo went back to the Shire.

Bilbo travelled to the Grey-havens.

The End.

Where is the ring? A: Mount-Doom

Where is Bilbo now? A: Grey-havens

Where is Frodo now? A: Shire

EXAMPLE OUTPUT

Fred went to the kitchen.

Fred picked up the milk.

Fred travelled to the office.

Where is the milk? A: office

Where does milk come from? A: milk come from cow

What is a cow a type of? A: cow be female of cattle

Where are cattle found? A: cattle farm become widespread in brazil

What does milk taste like? A: milk taste like milk

What does milk go well with? A: milk go with coffee

Where was Fred before the office? A: kitchen



COMPARISONS WITH PREVIOUS WORK

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Large-scale QA task (Fader et al. 2013):

Method	F-Score
(Fader et al. 2013)	0.54
(Bordes et al. 2014)	0.73
MemNN (embedding only)	0.72
MemNN (with BoW features)	0.82

COMPARISONS WITH PREVIOUS WORK

Simulation QA task:

	Difficulty 1			Difficulty 5	
Method	Actor w/o before	Actor	Actor + object	Actor	Actor + object
RNN	100%	60.9%	27.9%	23.8%	17.8%
LSTM	100%	64.8%	49.1%	35.2%	29.0%
MemNN $k=1$	97.8%	31.0%	24.0%	21.9%	18.5%
MemNN $k=1$ (+ time)	99.9%	60.2%	42.5%	60.8%	44.4%
MemNN $k=2$ (+ time)	100%	100%	100%	100%	99.9%



QUESTIONS?

Thank you!