

Table 10: Zero-shot prompts for each dataset.

Task	Zero-Shot Prompt
MGSM	Let’s think step by step. Question: {question}
XQuAD	{context} Question: {question}
XLSum	Summarize the context in one sentence. Title: {title} Context: {article}
X-CSQA	Question: {question}

Table 11: Assessing the baseline performance of Vicuna and Mistral across four representative multilingual tasks in selected languages, where Avg. is calculated among non-English languages.

Model	Task	En	De	Fr	Zh	Es	Ru	Avg.
Vicuna	XQuAD	57.5	50.3	—	55.7	55.7	—	53.9
	MGSM	20.4	14.8	14.8	12.8	13.2	10.0	13.1
	X-CSQA	57.8	43.8	40.1	43.2	44.3	26.0	39.5
	XLSum	13.1	—	14.2	61.1	10.4	20.8	26.6
Mistral	XQuAD	57.1	48.5	—	64.3	54.1	—	55.6
	MGSM	46.0	21.2	26.0	31.6	31.2	21.6	26.3
	X-CSQA	61.7	40.0	40.4	47.1	45.7	14.1	37.5
	XLSum	13.5	—	15.2	56.4	10.6	21.0	25.8

F Prompts

Table 10 shows the zero-shot prompts for each dataset. Note that when conducting tests in other languages, prompts are translated into the respective languages.

G Original Performance

Table 11 shows the original performance of Vanilla and Mistral on four tasks.

H Hyper-parameters

We adopt the performance on XQuAD in Chinese as the validation set to all languages and all tasks. Specifically, Table 12 shows the result on Vicuna when deactivating language-specific neurons in the understanding layer (D_U) and generation layer (D_G), where N_1 is the number of understanding layers and N_2 is the number of generation layer. We find that when setting $N_1 = 8$ and $N_2 = 2$, performance in English is influenced the least while performance in Chinese decreases the most. As for Mistral, the number is $N_1 = 6$ and $N_2 = 3$.

Table 12: XQuAD with Chinese on Vicuna.

Method	N_1	D_U ACC	N_2	D_G ACC
En-Vanilla		57.5		
Zh-Vanilla		55.5		
En-Deact Zh-D-Deact	8	57.7 (↑ 0.2) 44.9 (↓ 10.6)	4	54.7 (↓ 2.8) 54.6 (↓ 0.9)
En-Deact Zh-Deact	6	58.6 (↑ 1.1) 55.1 (↓ 0.4)	3	57.7 (↑ 0.2) 54.5 (↓ 1.0)
En-Deact Zh-Deact	4	57.3 (↓ 0.2) 53.9 (↓ 1.6)	2	58.4 (↑ 0.9) 54.1 (↓ 1.4)

Table 13: XQuAD with Chinese on Mistral.

Method	N_1	D_U ACC	N_2	D_G ACC
En-Vanilla		57.1		
Zh-Vanilla		64.3		
En-Deact Zh-Deact	8	53.3 (↓ 3.8) 52.6 (↓ 11.7)	4	55.8 (↓ 1.3) 62.9 (↓ 1.4)
En-Deact Zh-Deact	6	56.8 (↓ 0.3) 54.9 (↓ 9.4)	3	56.3 (↓ 0.8) 62.7 (↓ 1.6)
En-Deact Zh-Deact	4	57.6 (↑ 0.5) 61.8 (↓ 2.5)	2	55.7 (↓ 1.4) 63.8 (↓ 0.5)

I Detailed Experiment Results

I.1 Detailed Experiment Settings

Reasoning Task Deactivation methods: (i) randomly sampled neurons in the attention structure of task-solving layer. (ii) randomly sampled neurons in the task-solving layer. (iii) randomly sampled neurons in all layers. (iv) language-specific neurons in the task-solving layer. (v) language-specific neurons in the understanding layer and generation layer. (vi) language-specific neurons not in the attention structure of task-solving layers.

Knowledge Question Answering Task Deactivation methods: (i) randomly sampled neurons in the feed-forward structure of task-solving layers. (ii) randomly sampled neurons in the task-solving layer. (iii) randomly sampled neurons in all layers. (iv) language-specific neurons in the attention structure of task-solving layers. (v) language-specific neurons in the feed-forward structure of task-solving layers.

Generation Task Deactivation methods: (i) randomly sampled neurons in the generating layers. (ii) randomly sampled neurons in all layers. (iv) language-specific neurons in the generating layers.

I.2 Detailed Result

Due to the limited space, we employ a more concise notation. We denote deactivating neurons in the self-attention layer of the i -th layer as $D_i^{(A)}$, while deactivating neurons in the feed-forward layer of the i -th layer is denoted as $D_i^{(F)}$. We denote $\mathcal{U} = \{1, \dots, N_1\}$ as the set of layers that take charge of understanding as shown in Figure 2. Similarly, we denote $\mathcal{S} = \{N_1 + 1, \dots, N_2\}$ as the set of layers that take charge of task solving and $\mathcal{G} = \{N_2 + 1, \dots, 32\}$ as the set of layers that take charge of generation⁵. Furthermore, $D_{\mathcal{U}}^{(A)}$ represents deactivating neurons in self-attention layers of \mathcal{U} . Similarly, we introduce $D_{\mathcal{U}}^{(F)}$, $D_{\mathcal{S}}^{(A)}$, $D_{\mathcal{S}}^{(F)}$, $D_{\mathcal{G}}^{(A)}$ and $D_{\mathcal{G}}^{(F)}$.

Table 14: Understanding task.

Method	German				Chinese				Spanish				
	En-D	De-D	$\Delta_{\text{En-D}}$	$\Delta_{\text{De-D}}$	En-D	Zh-D	$\Delta_{\text{En-D}}$	$\Delta_{\text{Zh-D}}$	En-D	Es-D	$\Delta_{\text{Es-D}}$	$\Delta_{\text{Es-D}}$	
Vicuna	$D_{\mathcal{U}}^R$	57.8	49.7	+0.3	-0.6	57.8	55.8	+0.3	+0.1	57.8	56.1	+0.3	+0.4
	D_{All}^R	57.9	50.8	+0.4	+0.5	57.9	55.8	+0.4	+0.1	57.9	55.9	+0.4	+0.2
	$D_{\mathcal{U}}$	55.7	40.7	-2.0	-9.6	57.7	44.9	+2.0	-10.8	56.1	52.4	-1.4	-3.2
	$D_{\mathcal{S}}$	48.3	41.7	-7.2	-8.6	45.0	45.4	-12.5	-10.3	29.5	28.6	-28.0	-27.1
	$D_{\mathcal{G}}$	57.5	50.1	0.0	-0.2	58.4	54.1	+0.9	-1.6	57.7	54.1	+0.2	-1.6
Mistral	$D_{\mathcal{U}}^R$	58.1	48.2	+1.0	-0.4	58.1	63.9	+1.0	-0.4	58.1	54.3	+1.0	+0.2
	D_{All}^R	57.6	48.3	+0.5	-0.3	57.6	63.6	+0.5	-0.7	57.6	54.5	+0.5	+0.4
	$D_{\mathcal{U}}$	56.5	42.4	-0.6	-6.2	56.8	54.9	-0.3	-9.4	55.4	47.5	-1.7	-6.6
	$D_{\mathcal{S}}$	54.3	43.2	-2.8	-5.4	54.9	52.9	-2.2	-11.4	50.3	44.9	-6.8	-9.2
	$D_{\mathcal{G}}$	56.7	47.9	-0.4	-0.7	56.3	62.7	-0.8	-1.6	56.2	53.2	-0.9	-0.8

⁵Vicuna-7b-v1.5 and Mistral-7b-v1.0 both have 32 layers.

Table 15: Reasoning task.

Method	German				French				Chinese				Spanish				Russian				
	En-D	De-D	Δ_{En-D}	Δ_{De-D}	En-D	Fr-D	Δ_{En-D}	Δ_{Fr-D}	En-D	Zh-D	Δ_{En-D}	Δ_{Zh-D}	En-D	Es-D	Δ_{En-D}	Δ_{Es-D}	En-D	Ru-D	Δ_{En-D}	Δ_{Ru-D}	
Vicuna	$D_{S(A)}^R$	20.0	12.4	-0.4	-2.4	20.0	13.6	-0.4	-1.2	20.0	13.2	-0.4	+0.4	20.0	12.4	-0.4	-0.8	20.0	4.8	-0.4	-5.2
	D_S^R	18.4	12.4	-2.0	-2.4	18.4	14.0	-2.0	-0.8	18.4	14.4	-2.0	+1.6	18.4	15.2	-2.0	+2.0	18.4	4.8	-2.0	-5.2
	D_{All}^R	19.6	14.0	-0.8	-0.8	19.6	13.8	-0.8	-1.0	19.6	14.8	-0.8	+2.0	19.6	12.4	-0.8	-0.8	19.6	7.6	-0.8	-2.4
	D_S	3.6	2.0	-16.8	-12.8	8.4	3.2	-12.0	-11.6	4.8	4.0	-15.6	-8.8	8.8	4.0	-11.6	-9.2	10.4	4.0	-10.0	-6.0
	$D_{U\&G}$	16.4	5.6	-4.0	-9.2	19.2	9.6	-1.2	-5.2	20.0	9.2	-0.4	-3.6	17.6	11.6	-2.8	-1.6	17.2	5.6	-3.2	-4.4
	$\bar{D}_{S(A)}$	16.8	4.4	-3.6	-10.4	19.6	8.8	-0.8	-4.4	21.6	9.6	+1.2	-3.2	19.6	10.4	-0.8	-2.8	17.2	5.6	-3.2	-4.4
Mistral	$D_{S(A)}^R$	40.8	18.0	-5.2	-3.2	40.8	25.6	-5.2	-0.4	40.8	24.0	-5.2	-7.6	40.8	29.2	-5.2	-2.0	40.8	20.4	-5.2	-1.2
	D_S^R	39.2	20.0	-6.8	-1.2	39.2	25.2	-6.8	-0.8	39.2	25.6	-6.8	-6.0	39.2	29.6	-6.8	-1.6	39.2	19.6	-6.8	-2.0
	D_{All}^R	45.2	24.0	-0.8	+2.8	45.2	27.6	-0.8	+1.6	45.2	31.2	-0.8	-0.4	45.2	30.4	-0.8	-0.8	45.2	20.8	-0.8	-0.8
	D_S	38.4	12.0	-7.6	-9.2	40.8	24.8	-5.2	-1.2	37.9	19.6	-8.1	-12.0	40.4	24.4	-5.6	-6.8	33.6	11.2	-12.4	-10.4
	$D_{U\&G}$	42.4	9.2	-3.6	-12.0	41.2	21.6	-4.8	-4.4	46.4	19.6	+0.4	-12.0	44.0	28.0	-2.0	-3.2	46.0	12.0	+0.0	-9.6
	$\bar{D}_{S(A)}$	43.6	9.6	-2.4	-11.6	44.8	19.2	-1.2	-6.8	46.4	18.8	+0.4	-12.8	47.6	27.6	+1.6	-3.6	48.4	16.4	+2.4	-5.2

Table 16: Knowledge Question Answering task.

Method	German				French				Chinese				Spanish				Russian				
	En-D	De-D	Δ_{En-D}	Δ_{De-D}	En-D	Fr-D	Δ_{En-D}	Δ_{Fr-D}	En-D	Zh-D	Δ_{En-D}	Δ_{Zh-D}	En-D	Es-D	Δ_{En-D}	Δ_{Es-D}	En-D	Ru-D	Δ_{En-D}	Δ_{Ru-D}	
Vicuna	$D_{S^{(F)}}^R$	57.5	43.8	-0.3	+0.0	57.5	40.3	-0.3	+0.2	57.5	43.2	-0.3	+0.0	57.5	44.6	-0.3	+0.3	57.5	25.5	-0.3	-0.5
	D_S^R	56.0	44.0	-1.8	+0.2	56.0	38.6	-1.8	-1.5	56.0	43.4	-1.8	+0.2	56.0	43.5	-1.8	-0.8	56.0	24.0	-1.8	-2.0
	D_{All}^R	57.7	43.6	-0.1	-0.2	57.7	40.5	-0.1	+0.4	57.7	43.2	-0.1	+0.0	57.7	44.5	-0.1	+0.2	57.7	26.0	-0.1	+0.0
	$D_{S^{(A)}}$	34.8	43.4	-23.0	-0.4	32.6	31.1	-25.2	-12.7	32.6	28.9	-25.2	-14.3	20.4	25.0	-37.1	-19.3	48.3	22.9	-9.5	-3.1
	$D_{S^{(F)}}$	57.8	41.5	+0.0	-2.5	57.2	37.8	-0.6	-6.0	56.9	39.6	-0.9	-3.6	57.6	43.0	-0.2	-1.3	57.8	25.6	+0.0	-0.4
Mistral	$D_{S^{(F)}}^R$	61.0	40.2	-0.7	+0.2	61.0	40.1	-0.7	-0.3	61.0	46.7	-0.7	-0.4	61.0	45.2	-0.7	-0.5	61.0	12.7	-0.7	-1.4
	D_S^R	60.7	40.4	-1.0	+0.4	60.7	36.9	-1.0	-3.5	60.7	46.9	-1.0	-0.3	60.7	46.3	-1.0	+0.7	60.7	11.1	-1.0	-3.0
	D_{All}^R	61.8	40.1	+0.1	+0.1	61.8	40.7	+0.1	+0.3	61.8	47.2	+0.1	+0.1	61.8	44.7	+0.1	-1.0	61.8	14.1	+0.1	+0.0
	$D_{S^{(A)}}$	50.4	32.3	-11.3	-7.7	55.3	27.4	-6.4	-13.0	54.7	42.4	-7.0	-4.7	44.5	34.1	-17.2	-11.6	51.1	8.3	-10.6	-5.8
	$D_{S^{(F)}}$	61.5	38.1	-0.2	-1.9	61.2	38.1	-0.5	-2.3	61.3	43.5	-0.4	-3.6	61.0	43.9	-0.7	-1.8	60.8	11.8	-0.4	-2.3

Table 17: Generation task.

Method		French				Chinese				Spanish				Russian			
		En-D	Fr-D	Δ_{En-D}	Δ_{Fr-D}	En-D	Zh-D	Δ_{En-D}	Δ_{Zh-D}	En-D	Es-D	Δ_{En-D}	Δ_{Es-D}	En-D	Ru-D	Δ_{En-D}	Δ_{Ru-D}
Vicuna	D_G^R	13.2	14.2	+0.1	+0.0	13.2	61.6	+0.1	+0.5	13.2	10.4	+0.1	+0.0	13.2	20.8	+0.1	+0.0
	D_{All}^R	13.0	14.1	-0.1	-0.1	13.0	61.6	-0.1	+0.5	13.0	10.4	-0.1	+0.0	13.0	20.8	-1.0	+0.0
	D_G	13.0	13.8	-0.1	-0.4	13.1	59.5	+0.0	-1.6	13.0	9.1	-0.1	-1.3	13.1	20.3	+0.0	-0.5
Mistral	D_G^R	13.6	15.2	+0.1	+0.0	13.6	56.7	+0.1	+0.3	13.6	10.3	+0.1	-0.3	13.6	21.2	+0.1	+0.2
	D_{All}^R	13.6	15.4	+0.1	+0.2	13.6	55.9	+0.1	-0.5	13.6	10.2	+0.1	-0.4	13.6	21.1	+0.1	+0.1
	D_G	14.3	14.2	+0.8	-1.0	13.6	52.8	+0.1	-3.6	13.7	10.2	+0.2	-0.4	13.5	20.2	-0.1	-0.8