AnalogGPT

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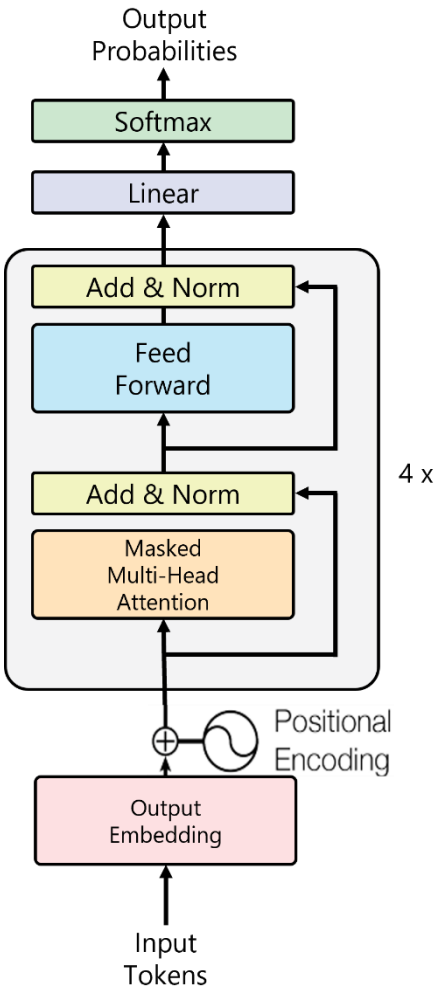
Output
Probabilities
Softmax
Linear
Add & Norm
Feed
Forward
Add & Norm
Masked
Multi-Head
Attention
4 x
Positional
Encoding
Output
Embedding
Input
Tokens

How to use

First, write your prompt (e.g., “The cat is”) on a blank paper and convert it into an array of token IDs using the tokenizer table (e.g., [70, 216, 18, 25]). Then, extract the positional embedding corresponding to the length of the token array (in this case, 4 → positions [0:4]) and add it to the token embeddings to obtain the **input embedding**. Next, apply **Layer Normalization** using the following formulas: compute the mean $\mu = \frac{1}{d}\sum_{i=1}^{d} x_i$, the variance $\sigma^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \mu)^2$, and normalize each input dimension as $\hat{x}_i = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}$. Then apply the learned scale and shift using $\mathrm{LN}(x)_i = \gamma_i \hat{x}_i + \beta_i$. This gives the first hidden state $\mathbf{h_0}$ with shape [4 × 12]. Use this to compute Q, K, and V matrices by applying the corresponding weights (each resulting in [4 × 12]), and compute attention by taking the dot product Q and K^T, applying softmax, and multiplying the result by V to get the attention output. Then, pass this through the masked multi-head self-attention block, followed by a **residual connection** that adds the attention output back to the input of the block. Apply a second layer normalization (LayerNorm2) to the result. Pass this through the first MLP layer using weights and biases of shape [4 × 48], apply the **GELU activation function**, and then pass through a second MLP layer to reduce the shape back to [4 × 12]. Again, apply a residual connection by adding the MLP output to the block input. Repeat this entire process—multi-head attention, residual connection, layer normalization, MLP, and another residual connection—for layers 2, 3, and 4. The final output after all layers retains the shape [4 × 12]. For the output stage, select the last token embedding from xfinalx_{\text{final}}xfinal; if multiple tokens are needed, retain the others as well. Multiply the selected vector by the output layer weight and add bias to produce a [1 × 300] logits vector. Finally, apply the **softmax** function to obtain a probability distribution over the vocabulary, and choose the token corresponding to the highest probability.

Tokenizer

0	<pad>	**1**	<unk>	**2**	<s>	**3**	</s>	**4**	_t	**5**	he	**6**	_a	**7**	in	**8**	_the	**9**	er	**10**	on	**11**	_,
12	re	**13**	_s	**14**	ed	**15**	_o	**16**	_w	**17**	nd	**18**	at	**19**	_.	**20**	or	**21**	it	**22**	_c	**23**	en
24	_f	**25**	is	**26**	es	**27**	ar	**28**	_of	**29**	_b	**30**	an	**31**	_in	**32**	al	**33**	ing	**34**	_p	**35**	_and
36	as	**37**	_to	**38**	ro	**39**	ic	**40**	_m	**41**	_d	**42**	_h	**43**	ion	**44**	le	**45**	ou	**46**	_T	**47**	_re
48	_=	**49**	_"	**50**	_A	**51**	_S	**52**	ent	**53**	il	**54**	_th	**55**	_1	**56**	st	**57**	_C	**58**	el	**59**	om
60	_l	**61**	am	**62**	_e	**63**	_n	**64**	_@	**65**	ad	**66**	ac	**67**	_was	**68**	_M	**69**	ur	**70**	_The	**71**	ec
72	_on	**73**	ly	**74**	_B	**75**	_I	**76**	_g	**77**	_'	**78**	et	**79**	ol	**80**	id	**81**	iv	**82**	im	**83**	_for
84	ir	**85**	-@	**86**	_@-@	**87**	ig	**88**	ot	**89**	ter	**90**	_as	**91**	_H	**92**	us	**93**	ow	**94**	_st	**95**	ut
96	ith	**97**	ay	**98**	_2	**99**	_P	**100**	ation	**101**	ver	**102**	_be	**103**	her	**104**	_that	**105**	_with	**106**	_R	**107**	ce
108	th	**109**	_D	**110**	_is	**111**	un	**112**	em	**113**	_F	**114**	_wh	**115**	ul	**116**	_by	**117**	_al	**118**	ch	**119**	_)
120	_(	**121**	_W	**122**	_con	**123**	ra	**124**	_G	**125**	os	**126**	_L	**127**	_N	**128**	_at	**129**	ers	**130**	ct	**131**	_it
132	_19	**133**	rom	**134**	and	**135**	_an	**136**	um	**137**	est	**138**	_J	**139**	ag	**140**	_he	**141**	00	**142**	ist	**143**	ain
144	od	**145**	av	**146**	ri	**147**	_E	**148**	_O	**149**	_from	**150**	_com	**151**	_his	**152**	op	**153**	_pro	**154**	res	**155**	ies
156	if	**157**	_v	**158**	ort	**159**	ere	**160**	ill	**161**	ld	**162**	_de	**163**	pp	**164**	_su	**165**	ore	**166**	_In	**167**	_r
168	_se	**169**	_were	**170**	ew	**171**	ong	**172**	igh	**173**	ard	**174**	ate	**175**	all	**176**	art	**177**	ak	**178**	ich	**179**	_ch
180	_or	**181**	ab	**182**	ant	**183**	ud	**184**	oc	**185**	ber	**186**	_ex	**187**	gh	**188**	ity	**189**	ated	**190**	pt	**191**	ess
192	ear	**193**	_K	**194**	_pl	**195**	ame	**196**	qu	**197**	ive	**198**	rou	**199**	_are	**200**	_sh	**201**	_k	**202**	ack	**203**	ect
204	_	**205**	e	**206**	t	**207**	a	**208**	n	**209**	i	**210**	o	**211**	r	**212**	s	**213**	h	**214**	l	**215**	d
216	c	**217**	u	**218**	m	**219**	f	**220**	g	**221**	p	**222**	w	**223**	y	**224**	b	**225**	,	**226**	.	**227**	v
228	k	**229**	@	**230**	1	**231**	T	**232**	0	**233**	A	**234**	S	**235**	=	**236**	"	**237**	C	**238**	M	**239**	2
240	I	**241**	B	**242**	9	**243**	'	**244**	-	**245**	H	**246**	P	**247**	x	**248**	R	**249**	D	**250**	F	**251**	N
252	W	**253**	L	**254**	)	**255**	(	**256**	G	**257**	3	**258**	5	**259**	8	**260**	J	**261**	E	**262**	O	**263**	4
264	6	**265**	7	**266**	z	**267**	j	**268**	K	**269**	q	**270**	U	**271**	V	**272**	;	**273**	–	**274**		**275**	Y
276	Z	**277**	/	**278**	—	**279**	é	**280**	Q	**281**	%	**282**	$	**283**	[	**284**	]	**285**	X	**286**	&	**287**	!
288	á	**289**	ā	**290**	í	**291**	’	**292**	£	**293**	°	**294**	ó	**295**	?	**296**	+	**297**	è	**298**	ō	**299**	ü

Token Embedding Weight (Embedding_Dim = 12)

1	-3.741246e-01	-6.359636e-01	-2.619245e-01	3.121038e-01	2.094382e-01	1.075720e+00	-4.619952e-01	4.249024e-02	-2.159138e-01	-5.736234e-01	1.266070e-01	-4.451426e-01
2	-7.353153e-01	-5.996881e-01	1.014305e+00	4.083213e-01	-1.571335e-01	6.998475e-01	6.791546e-02	1.905314e-01	-2.278671e-02	-3.782676e-01	3.491611e-02	3.402570e-01
3	3.467283e-02	2.548601e-01	4.086047e-02	1.717503e-01	-5.115746e-01	6.766837e-01	1.282385e-01	2.962483e-01	-3.473595e-01	-4.927135e-01	-5.789226e-01	2.419079e-01
4	1.069627e-01	2.027459e-01	7.700051e-02	-3.232928e-01	3.801017e-01	5.631875e-03	3.105607e-01	1.806552e-01	1.559680e-01	2.571816e-01	-3.157049e-01	-1.392332e-01
5	1.284529e-01	-2.380871e-01	8.687333e-01	2.930850e-01	1.185499e+00	-5.584015e-01	-2.329724e-01	-1.662668e-01	5.702108e-01	2.260734e-01	-1.919873e-01	3.451475e-01
6	-1.342812e-02	7.272981e-01	1.963617e-01	1.529339e-01	4.779461e-01	-3.960828e-01	1.632019e-01	7.358618e-01	5.218012e-01	1.696179e-02	3.237548e-01	-3.577949e-01
7	2.915032e-01	-3.489269e-02	6.340353e-02	-4.158981e-01	4.160497e-01	-4.152122e-01	5.910597e-01	4.619655e-02	-1.903221e-01	-1.838506e-01	-1.434972e-01	-9.567142e-01
8	-6.026332e-01	3.247442e-01	1.388659e-01	6.024736e-01	1.062524e-01	1.729565e-01	-2.108377e-01	-5.561347e-02	-1.459196e-02	4.286093e-02	-1.399781e-01	-2.736831e-02
9	3.553801e-01	8.200578e-02	1.826134e-01	1.508268e-02	3.613860e-01	4.750213e-03	5.276601e-01	2.174844e-01	1.150251e-01	2.198538e-01	-7.384960e-01	-7.126193e-01
10	-4.686502e-01	2.832316e-01	-3.188397e-01	-3.104689e-01	3.565649e-02	-1.762012e-01	1.095651e-01	2.794001e-01	3.103457e-01	-2.285425e-01	-4.667726e-01	-6.259897e-01
11	-3.769045e-01	1.961696e-01	-3.508306e-02	4.982104e-01	-2.481366e-01	3.312525e-01	-2.146422e-02	-8.358729e-02	-1.794412e-01	2.448799e-01	-2.173516e-01	-2.086928e-01
12	2.810138e-01	-1.051151e-01	-6.064624e-02	2.152081e-01	-5.393874e-01	2.288370e-01	-9.527911e-02	-4.808075e-01	-4.875821e-01	1.817241e-01	-6.001818e-01	-1.969526e-01
13	-3.759269e-01	8.759813e-01	8.191445e-02	2.563907e-01	9.820316e-02	-8.385955e-02	6.345936e-02	2.604657e-01	1.878369e-01	-1.160676e-01	2.501043e-01	2.864914e-02
14	-3.507758e-01	-5.043256e-01	8.031011e-01	8.032272e-01	5.278075e-01	-1.678835e-01	8.680293e-02	-1.893068e-01	1.286397e-01	8.487370e-01	5.555109e-01	6.183923e-01
15	4.047858e-01	1.883234e-01	-2.885724e-01	-2.416733e-02	-3.565985e-01	3.686874e-01	-3.711023e-01	-5.278273e-02	3.795477e-01	1.077237e-01	-5.796869e-01	2.329091e-02
16	-6.470322e-01	-3.384739e-01	1.510402e-01	1.915626e-01	1.040492e+00	-8.050457e-01	6.861634e-01	-3.257445e-01	-1.754623e-01	4.067573e-01	5.584681e-01	-4.232318e-01
17	1.682435e-01	-6.245732e-01	1.425062e+00	1.480113e-01	6.815319e-01	-5.000867e-01	1.012095e-01	7.418559e-02	7.084013e-01	4.940264e-01	1.581442e-01	8.549743e-01
18	-2.387830e-01	2.830384e-01	2.231746e-01	-1.511972e-02	-3.760754e-01	-2.006596e-01	-3.801146e-01	-4.870207e-01	-2.312145e-02	1.379384e-02	-3.233887e-01	4.774582e-01
19	-2.348181e-01	-5.290049e-02	-8.216100e-02	1.008585e-01	-4.721082e-01	-1.620399e-01	-6.923155e-01	-5.938687e-01	-2.473466e-01	-1.267873e-01	1.835161e-01	2.851944e-01
20	5.464725e-01	4.860434e-01	2.792165e-01	2.306858e-01	9.045330e-02	5.217069e-01	3.870041e-01	-3.840479e-01	-2.549053e-01	5.305757e-02	-1.181685e-01	2.825569e-01
21	-6.596212e-01	2.318089e-01	1.917708e-03	5.355712e-01	6.237117e-02	1.382089e-01	-5.063785e-02	5.203236e-01	4.207487e-01	2.565870e-01	-5.560579e-02	-2.421822e-01
22	-4.375865e-01	7.371452e-02	-2.370981e-01	-5.449254e-02	-4.334641e-01	-3.787960e-01	-1.076010e+00	-3.869490e-01	-8.539812e-03	-5.401996e-01	-1.085428e-01	-5.903808e-03
23	6.164281e-01	-6.553172e-01	3.392923e-01	1.356256e-01	7.342450e-01	-3.761473e-02	-4.424805e-01	1.436273e-02	7.966507e-01	5.029292e-01	6.051508e-01	4.462536e-01
24	-8.716955e-02	7.420007e-01	-3.105992e-01	-1.151167e-01	-2.642896e-01	-1.390395e-01	2.901450e-01	2.935485e-01	3.192998e-01	1.531366e-01	8.318524e-02	-1.076350e-01
25	4.855952e-01	-3.530156e-01	5.160901e-01	-4.579481e-02	6.365767e-01	-1.430010e-01	-3.859461e-01	5.483787e-01	1.254073e+00	4.115719e-01	-1.654300e-02	3.364155e-01
26	1.187748e-02	1.476845e-01	-5.255827e-01	-2.958370e-01	-6.565349e-01	6.523562e-02	1.564404e-02	-2.254566e-01	-5.924476e-02	1.501635e-02	4.905788e-01	-4.845830e-02
27	1.187731e-02	3.629892e-01	-1.677346e-01	-5.122992e-01	-4.149582e-01	1.543900e-01	5.194840e-01	2.270150e-02	-6.292372e-03	-2.247434e-01	9.540474e-02	-2.214405e-01
28	-2.766705e-01	6.295751e-01	-2.813250e-01	7.562449e-02	1.472348e-01	-5.672444e-02	-3.982165e-01	3.249701e-01	5.984972e-01	-1.794218e-01	-8.456100e-02	-1.369748e-01
29	4.135862e-02	2.660182e-01	-1.070185e-01	1.881003e-01	-1.555656e-01	1.078080e-01	9.644274e-02	-4.679268e-01	-4.388032e-01	-2.910905e-02	-8.527181e-01	-3.588705e-01
30	-3.269448e-01	-9.168607e-01	5.426850e-01	-1.574035e-01	1.075410e+00	-5.091579e-01	-1.598323e-01	-3.499114e-01	1.983279e-01	-3.315790e-01	4.373586e-01	-1.005001e-02
31	-7.587793e-02	6.396311e-01	-3.738569e-01	2.654343e-01	-2.313420e-02	4.824351e-01	7.760686e-02	1.439420e-01	3.451670e-01	2.040722e-01	1.037700e-01	-1.836074e-02
32	4.419639e-02	4.240375e-01	8.042527e-03	1.018647e-01	-9.640117e-02	-1.509566e-01	4.996216e-01	-3.827031e-01	-5.944813e-01	8.557582e-02	-3.172722e-01	-3.511923e-01
33	-6.580539e-02	6.277527e-01	-4.941296e-01	-2.197353e-01	-8.356217e-04	6.733745e-02	-9.929182e-02	-1.295157e-01	2.419459e-01	-2.520447e-01	-4.648413e-01	-2.171812e-01
34	9.596699e-02	3.891764e-01	-2.191116e-01	1.733603e-01	-1.339736e-01	3.405188e-01	-2.958721e-01	-1.475393e-01	1.221352e-01	-7.873219e-02	-7.393892e-01	-1.154481e-01
35	6.785265e-02	-7.442403e-01	-2.638059e-01	-8.026627e-01	4.379361e-01	-7.647990e-01	-7.995994e-01	-5.809360e-01	2.178549e-01	-5.928018e-01	-8.622745e-02	-3.596630e-01
36	2.766337e-01	-1.894154e-01	-1.541874e-01	1.023968e-01	-3.747013e-01	9.698736e-02	-4.886083e-02	-1.052799e-01	-8.354484e-02	3.211825e-01	-1.021455e+00	-5.095027e-01
37	-2.533658e-01	2.205839e-01	1.373449e-01	2.844949e-01	-4.919519e-01	1.902598e-01	-4.137455e-02	-2.071862e-01	-2.400187e-01	1.044110e-01	3.770865e-01	2.117995e-01
38	7.343245e-01	5.820661e-01	-1.320540e-01	9.951511e-02	2.219942e-01	-9.289251e-02	6.573648e-02	-3.912631e-01	-1.486294e-01	3.162678e-02	-5.329723e-01	-2.271891e-01
39	-8.701636e-03	7.911878e-01	-2.578035e-01	1.079105e-01	3.436117e-01	-3.971726e-01	-9.613451e-03	4.476804e-01	6.375737e-01	2.326715e-01	6.699937e-01	3.104901e-04
40	-3.051059e-01	1.668366e-01	-2.784700e-01	2.030129e-01	-6.265243e-02	1.010338e-01	-4.095863e-01	3.578996e-01	7.112590e-01	3.057080e-01	-4.845263e-01	-1.031866e-01
41	5.102268e-02	-8.403216e-01	3.520824e-01	-5.286848e-02	4.169939e-01	5.854640e-02	-3.659338e-01	6.147039e-01	8.308720e-01	-3.167620e-02	5.296530e-01	-8.573918e-02
42	-3.241666e-01	-6.264162e-01	6.310352e-01	3.833021e-01	4.078305e-01	-3.899396e-01	-9.002727e-01	-2.405254e-01	1.869247e-01	-7.126293e-02	1.308406e-02	2.870940e-01
43	-2.996103e-01	-1.222547e-01	1.268053e+00	6.478647e-01	1.023386e+00	-9.439889e-02	4.322594e-01	9.113930e-01	7.714936e-01	2.115714e-01	9.898560e-01	3.825802e-01
44	-4.417183e-02	4.388018e-02	-1.846232e-01	-2.383762e-01	-5.217836e-01	4.711094e-02	2.174854e-02	4.192283e-01	6.143690e-01	3.769628e-01	-4.836476e-01	-5.262929e-02
45	-3.152576e-02	5.942833e-01	9.534639e-02	-2.379134e-01	-3.063719e-01	-3.651257e-01	3.489229e-01	3.132660e-01	-2.192014e-02	-1.837462e-01	5.086760e-01	-2.098434e-01
46	-5.745218e-01	2.164459e-01	9.847016e-01	-5.029922e-02	1.102726e-01	-1.204358e+00	6.510450e-01	2.753606e-01	-7.733325e-02	1.552421e-01	-2.464504e-02	-5.779879e-02
47	4.232890e-01	-2.949391e-01	4.143648e-01	1.074739e-01	5.568328e-01	-2.349896e-01	-2.795808e-01	-7.610729e-01	-4.172907e-02	2.141398e-01	2.792902e-01	4.485062e-01
48	1.165421e-01	5.138560e-01	-5.070208e-01	2.123127e-01	5.158896e-01	-7.980426e-01	-5.988380e-02	-2.564505e-01	4.080430e-02	4.300995e-01	1.550028e-01	-3.539450e-01
49	-5.969083e-02	-1.622718e-01	-3.604194e-01	6.117901e-01	-3.767240e-02	3.484871e-01	5.128348e-01	6.514845e-01	-1.489693e-01	-2.260458e-02	-4.361068e-01	1.257322e-01
50	2.207042e-01	-8.683667e-02	2.645082e-01	-1.286819e-01	-1.208915e-01	3.296961e-01	8.440375e-01	6.735270e-02	-2.690259e-01	1.664952e-01	-4.269302e-01	-5.004807e-01
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53	4.660562e-01	6.256599e-01	-2.049326e-01	-4.653671e-01	-2.541691e-01	-9.148897e-02	9.610642e-03	-2.610784e-02	2.301838e-01	-3.157910e-01	7.070944e-02	-2.089132e-02
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59	-7.030926e-03	7.519777e-01	-3.165344e-01	-4.351673e-03	-6.127136e-02	5.768574e-02	2.440925e-02	2.519632e-02	3.711978e-02	-2.959248e-01	4.900912e-01	-1.533067e-01
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61	-8.725461e-01	-1.005107e+00	7.583888e-01	2.740695e-01	6.258930e-02	-5.812266e-01	-5.078385e-01	4.100746e-01	3.633873e-01	4.205757e-02	8.855183e-02	8.923900e-02
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84	5.118678e-01	5.546492e-01	-2.545007e-01	1.621666e-01	-3.306990e-01	-3.203870e-01	2.007154e-01	-4.412411e-01	-4.000308e-01	3.522437e-01	-4.410129e-01	-1.526501e-01
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126	-3.370503e-01	5.254698e-02	-3.023542e-01	2.391058e-01	-3.772225e-01	1.064339e-01	-4.389487e-01	2.546537e-01	5.516208e-01	3.403308e-01	6.746435e-01	3.214493e-01
127	2.391261e-01	-7.384886e-01	5.161695e-01	4.039188e-01	-1.036062e-01	9.457939e-02	-4.591707e-01	1.781046e-01	1.916412e-01	3.644560e-01	6.791335e-01	2.438520e-01
128	-3.300616e-01	-1.225367e+00	5.730574e-01	-2.138434e-01	1.577377e-01	-3.062818e-01	-2.950189e-01	-3.957827e-02	2.765137e-01	6.389124e-02	6.818454e-01	3.382380e-01
129	2.613266e-01	3.513777e-01	1.765832e-01	2.341282e-01	-3.758461e-01	-3.269853e-01	3.092923e-01	-4.686687e-01	-6.205289e-01	3.796761e-01	-1.741085e-01	-7.698196e-02
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132	4.687323e-01	-1.158457e-01	1.079014e-01	-7.532669e-01	-5.216203e-01	-4.414011e-01	4.965471e-01	-3.249586e-03	4.429425e-01	5.368593e-01	-5.422855e-01	8.303346e-02
133	8.758035e-02	-3.753542e-01	9.297793e-01	-2.711868e-01	8.166780e-01	-5.166140e-01	7.059301e-01	-5.363944e-01	-4.436592e-01	-6.481368e-02	4.648317e-02	-1.333314e-01
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165	1.072433e-01	3.336951e-02	-3.352481e-01	-2.101657e-01	8.314605e-01	-4.701892e-01	7.455742e-01	-4.160446e-03	3.825372e-01	6.317374e-01	8.728409e-01	-4.028763e-01
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167	4.544957e-01	-1.647051e-01	1.416202e-01	1.012600e-01	-3.600661e-01	-1.421770e-01	3.085525e-01	-7.068368e-01	-6.515374e-01	5.047440e-01	-1.568010e-01	-2.396133e-02
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170	6.270262e-01	7.942342e-02	-3.549142e-01	-3.230757e-01	-5.628774e-01	-2.437722e-01	-1.755217e-02	-1.602978e-01	3.792772e-02	1.720856e-01	-8.995581e-01	-3.963896e-01
171	8.871739e-03	4.652928e-01	-2.799748e-01	-2.311430e-02	-1.672687e-01	4.271742e-01	3.212861e-01	-2.901959e-01	1.714798e-01	3.692640e-01	-4.248637e-02	3.506436e-01
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173	-4.235910e-01	3.565962e-01	2.431331e-01	4.515586e-01	-1.891070e-01	-7.402130e-02	1.549632e-01	-4.235519e-01	-4.565335e-01	2.481928e-01	1.711907e-01	2.457281e-02
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175	-5.584837e-02	6.363093e-01	-2.109669e-01	-8.600851e-02	-2.105197e-01	3.466185e-01	4.014176e-01	-9.450588e-02	1.531564e-01	4.183863e-02	-4.208534e-01	1.169114e-01

176	-7.733328e-01	2.789132e-01	-1.554380e-01	-2.857808e-01	-4.010830e-01	1.804827e-01	6.351206e-02	-3.340852e-01	4.386541e-02	-2.105070e-01	-1.997816e-01	2.658501e-01
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179	3.846819e-01	2.482497e-02	-3.767471e-01	-1.018396e-01	-5.236810e-01	3.241252e-01	1.510372e-01	-1.210874e-02	1.933719e-01	3.805063e-01	4.409697e-02	-1.067059e-01
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181	4.162761e-01	-3.800634e-01	8.740348e-03	1.120453e-01	-3.788879e-01	8.334250e-02	9.318610e-02	5.225635e-01	2.088318e-01	5.218043e-01	-8.408196e-02	-6.355857e-01
182	-1.527513e-01	1.850072e-01	-6.845530e-01	5.411987e-02	2.537275e-01	-9.225702e-02	-5.545850e-01	-4.810834e-02	3.871633e-01	-2.539710e-01	6.928195e-01	-3.262368e-01
183	2.098096e-01	4.604226e-01	-4.292139e-01	-1.496902e-01	-3.538717e-01	-2.040273e-01	-5.980922e-01	-1.206089e-01	3.565229e-01	-9.040637e-02	-3.552805e-01	6.370462e-03
184	-6.590132e-01	1.648354e-01	1.103570e-01	4.962743e-01	-3.663258e-01	2.999535e-02	-5.985978e-01	2.252856e-01	3.781907e-01	2.031019e-01	7.370067e-02	3.070031e-01
185	-4.128876e-01	-1.392493e-01	-2.463764e-01	2.897656e-01	-1.980336e-01	3.802862e-01	-4.675684e-01	4.464720e-01	7.432358e-01	2.601280e-01	9.408810e-02	3.240718e-02
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187	-6.111903e-01	-1.117191e-01	2.008518e-01	5.618430e-01	1.000459e+00	-3.772844e-01	2.573159e-01	-7.034310e-01	-1.642998e-02	6.564607e-01	7.493331e-01	4.907774e-01
188	-1.360400e-01	4.839198e-01	1.254741e-01	3.917989e-01	-2.499960e-01	-2.160189e-01	-2.715167e-01	-1.453384e-01	-1.444006e-01	1.855559e-01	-1.487404e-01	9.604572e-02
189	4.074989e-01	3.464710e-01	-1.730223e-01	-6.317441e-01	-1.325307e-01	2.098428e-01	-6.967615e-02	3.348131e-02	5.067431e-01	-4.562891e-01	-3.486382e-01	-8.648559e-02
190	8.461819e-02	2.862630e-01	-2.372925e-01	-2.516228e-01	-5.989994e-01	4.670087e-01	1.105291e-02	-2.218902e-01	1.665802e-01	-1.218554e-01	-6.736304e-01	1.724802e-01
191	-1.675586e-01	-2.374613e-01	3.772244e-02	-5.233612e-01	-6.533467e-01	-4.596979e-01	-4.759604e-01	-7.832172e-01	-4.540391e-01	-3.323638e-01	-2.528396e-02	3.245061e-01
192	-3.577543e-01	1.674148e-01	-4.339914e-01	-8.521488e-01	-6.256570e-01	-2.948227e-01	-9.654564e-02	-3.069706e-01	7.264467e-02	-4.940912e-01	1.249784e-01	2.947886e-02
193	-2.031196e-01	2.209434e-01	2.818484e-02	1.324260e-01	-2.977887e-01	2.666923e-01	4.721690e-01	2.298138e-02	3.256764e-01	7.517412e-01	-2.872055e-01	3.112074e-01
194	3.315489e-01	-5.113666e-01	4.310817e-01	2.086334e-01	-2.211928e-02	-2.569171e-01	-2.524707e-01	-2.569514e-01	-1.842375e-01	3.112560e-01	7.868536e-01	2.160138e-01
195	2.722345e-01	-3.014695e-01	8.342195e-01	3.081196e-01	5.938376e-01	-7.482275e-02	-1.371346e+00	1.444926e+00	1.429598e+00	-7.287897e-01	2.049428e-01	-2.870935e-01
196	1.673314e-01	2.554596e-01	-4.754379e-01	-4.462042e-01	-6.222599e-01	2.363156e-01	3.320405e-01	9.960091e-02	3.609715e-01	2.161544e-01	-1.244276e-01	-7.673066e-02
197	-2.086623e-01	-3.139944e-01	2.034244e-02	-1.721060e-01	5.329785e-01	-3.919781e-02	-5.313936e-01	1.457703e-01	1.080138e+00	-1.871149e-03	5.127922e-01	5.979978e-01
198	-1.510029e-01	2.180596e-01	-3.350052e-01	-2.857452e-01	-3.635767e-01	1.338068e-01	2.755744e-01	9.321355e-02	2.419273e-01	1.072366e-01	-8.191651e-01	-3.634662e-01
199	-2.203053e+00	-2.876682e-01	-1.663768e-01	-7.928367e-01	-1.693229e-01	-1.220698e+00	1.418618e+00	1.118043e+00	1.240373e+00	9.862832e-01	1.036792e+00	7.635851e-01
200	4.344312e-01	4.169170e-01	-3.642471e-01	-2.649802e-01	-3.150773e-01	-1.180046e-01	3.396922e-01	9.645478e-02	1.305600e-01	2.068856e-01	-4.779698e-01	-4.429203e-01
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202	2.032424e-01	1.607999e-01	8.662828e-01	9.238827e-01	4.331316e-01	-2.726348e-01	-3.012190e-01	4.155703e-01	4.518902e-01	7.171440e-01	-1.176974e-01	2.141287e-01
203	-2.939008e-01	-2.071914e-01	-1.883510e-01	-1.958914e-01	-1.083605e+00	-2.241644e-01	-3.386002e-01	3.910598e-01	2.141394e-01	2.232760e-01	-7.151319e-02	-1.992350e-01
204	-2.207816e-01	-1.381311e-01	-4.312703e-01	-8.808265e-01	-7.996372e-01	-6.761969e-01	-3.003641e-01	-3.004634e-01	1.829838e-01	-1.127411e-01	-3.510410e-02	1.510257e-01
205	-4.877453e-01	-1.158297e+00	7.401334e-01	2.493140e-01	4.202875e-01	-5.367844e-01	-3.803710e-01	-2.552047e-01	-3.365738e-01	-2.029877e-01	-7.466987e-01	-6.775837e-01
206	-3.289523e-01	4.003531e-01	-7.426591e-02	-1.956593e-01	9.897769e-02	1.837342e-01	3.857734e-01	2.302058e-02	-1.048276e-01	-4.341396e-01	-8.256664e-02	-4.261758e-01
207	1.230223e-01	4.615065e-01	4.286053e-01	-9.907424e-02	2.319458e-01	-7.744752e-02	-2.139764e-01	-3.594207e-01	-9.743488e-02	-5.091190e-01	-2.855699e-02	2.543674e-01
208	-1.961300e-01	2.150021e-01	-4.272103e-01	-3.237113e-01	1.995221e-01	3.803752e-01	1.818843e-01	2.670936e-01	5.054057e-01	-3.474822e-01	2.297151e-01	-3.576230e-01
209	-4.310270e-01	3.691955e-01	2.412518e-01	2.010708e-01	-5.236359e-02	-1.125491e-01	-2.580765e-01	-3.947257e-01	-3.657421e-01	-3.469889e-01	-2.512258e-01	-4.060401e-02
210	1.183822e-01	2.983031e-01	-4.753091e-01	-1.175722e-01	3.600947e-01	5.409912e-01	-3.883418e-02	3.151663e-01	1.002291e+00	9.075172e-02	3.393277e-01	1.221641e-01
211	-4.652836e-02	9.152368e-02	-3.965983e-01	-2.217260e-01	-3.179353e-01	3.625419e-01	3.188671e-01	1.753325e-01	8.512557e-02	-6.816698e-02	3.946857e-01	-4.364824e-01
212	-4.548308e-01	2.789484e-02	8.111357e-02	3.421755e-01	-1.649174e-02	-4.289892e-01	-9.089416e-01	1.278281e-01	9.494906e-02	-3.307792e-01	-2.357002e-01	-3.978338e-01
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214	4.430606e-01	1.301997e-01	9.542987e-02	-5.422660e-01	-5.102699e-02	-2.504508e-02	9.847063e-02	5.916255e-01	5.558289e-01	-2.960285e-01	4.801390e-01	-3.516127e-01
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217	-1.786555e-01	1.522292e-01	1.565069e-01	-4.049970e-01	6.190230e-01	-2.608974e-01	1.499263e-02	1.155770e-01	4.347643e-01	-5.210809e-01	7.545564e-01	2.009464e-02
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220	-3.313906e-01	2.487069e-01	3.401491e-01	-5.134801e-01	4.336483e-01	-8.282899e-01	6.903070e-02	-2.765179e-01	-1.030117e-01	-5.095412e-01	1.332761e-01	-3.314520e-02
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222	2.785065e-01	1.626528e-01	-1.763251e-01	-4.504046e-01	-7.063820e-02	-1.729795e-01	-5.609900e-01	-5.000769e-01	3.449436e-02	-4.936181e-01	1.279834e-01	6.914249e-02
223	-1.380563e-01	3.607862e-01	9.450244e-01	5.112270e-01	5.062242e-01	3.382274e-01	1.787901e-01	2.337618e-01	1.027133e-01	-2.244682e-01	6.864782e-01	4.011850e-01
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225	2.841581e-01	2.253319e-01	2.990640e-01	8.825222e-02	6.433077e-01	1.461996e-01	-2.817238e-01	5.442081e-02	2.906279e-01	-4.729668e-01	5.986360e-01	-4.956581e-03
226	1.286579e-01	-1.552378e+00	-1.013709e+00	-1.279354e+00	-1.228786e-01	2.190946e-01	4.865931e-01	-1.828954e-01	-4.397669e-01	-7.191818e-01	-1.209956e-01	2.264888e-01
227	5.008646e-01	-4.516780e-01	-2.059127e-01	-5.108896e-01	-1.370780e-01	5.723587e-01	1.554375e-01	-3.497384e-01	1.097599e-01	6.003267e-02	1.462695e-01	4.440624e-02
228	-1.146597e-01	-5.401651e-01	1.722885e-01	1.959609e-01	-1.353318e-01	2.845201e-02	-8.890724e-01	-1.257116e-01	4.872407e-01	1.498401e-01	1.944320e-01	4.795604e-01
229	3.528162e-01	3.678168e-01	8.623333e-02	3.706740e-01	-2.033089e-01	4.865004e-01	-1.143765e-01	-2.919655e-01	2.299581e-02	2.787080e-01	1.136566e-01	4.308503e-01
230	8.297504e-01	2.828755e-01	4.815226e-01	1.409331e-01	-1.590501e+00	8.951548e-01	6.538306e-01	8.878293e-01	-2.447069e-01	6.307620e-01	2.330924e-01	3.578869e-01
231	3.168509e-01	-4.825515e-01	9.991539e-02	-4.565611e-01	1.849441e-01	5.152364e-01	3.963914e-01	-5.439737e-01	-3.688154e-01	-3.406523e-01	3.270119e-01	-8.980460e-02
232	1.477464e-01	-4.360021e-01	-1.943696e-01	-6.185059e-01	-9.638694e-02	2.191581e-01	1.202848e-01	-6.324720e-01	-2.576615e-03	-2.248614e-02	4.300749e-01	2.244978e-01
233	2.871042e-01	-7.472298e-01	4.917740e-02	-4.935309e-01	-3.470660e-01	-8.081342e-02	7.896811e-01	-7.138157e-01	-1.775653e-01	1.021483e+00	1.847215e-01	2.608243e-01
234	2.488968e-01	-2.860262e-01	-3.842672e-01	-8.399936e-01	-8.698823e-02	2.391359e-01	2.886117e-01	-2.062555e-01	4.021360e-01	-2.527372e-03	3.770222e-01	5.100919e-02

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236	1.706716e-01	3.995527e-01	1.772091e-01	1.905046e-01	-1.778520e-01	2.063381e-01	4.919735e-01	-1.816718e-02	-4.893246e-02	-4.076943e-02	1.822132e-01	3.397176e-01
237	-1.302673e-01	5.535506e-02	2.438444e-01	-7.160276e-01	-7.026951e-02	-4.477931e-01	-1.967876e-02	6.098392e-02	3.022284e-01	4.872319e-02	2.925949e-01	-1.817039e-01
238	9.450573e-02	-1.743166e-01	-2.820453e-01	-8.613225e-01	5.501837e-02	6.613294e-02	1.274303e-01	-5.636309e-01	2.960688e-01	-1.588683e-01	1.418919e-01	2.693116e-01
239	-6.817693e-02	4.509832e-02	3.131566e-01	-5.714663e-01	1.326662e-01	4.769649e-02	3.033397e-01	-2.462094e-01	1.711168e-01	-2.825512e-01	6.662745e-01	4.752507e-01
240	3.147916e-01	-2.901776e-01	8.407516e-02	-9.085026e-01	-8.277557e-02	5.824113e-02	6.692150e-01	-2.128182e-01	1.247034e-01	1.166005e-01	2.578224e-01	4.616353e-02
241	-4.930947e-02	-1.014886e-01	-1.931743e-02	-9.489125e-01	2.035911e-01	-2.738845e-01	2.567736e-01	-5.270936e-01	2.685188e-01	-2.053098e-01	1.737762e-02	2.220847e-01
242	-9.754366e-02	-3.784134e-01	-3.726872e-01	-8.643580e-01	1.571269e-01	-3.838317e-01	2.576426e-01	-6.351410e-01	1.209675e-01	1.092434e-01	4.291867e-01	1.132039e-01
243	-2.806887e-01	-4.490880e-01	7.672134e-01	-2.452981e-01	6.949025e-03	1.812600e-01	5.075857e-01	-5.775094e-01	-3.590971e-01	3.164726e-02	2.214784e-01	5.546067e-01
244	-3.381706e-01	-6.479121e-01	5.995859e-01	1.056362e-01	1.141349e-01	-3.088647e-01	-3.854123e-01	-2.031983e-01	1.014476e-01	4.895081e-02	-2.079311e-01	-5.263112e-01
245	-2.165533e-02	6.504576e-01	-4.660892e-01	-2.781939e-01	-3.213533e-02	4.219396e-01	2.754810e-01	5.591072e-02	6.014415e-01	-7.522842e-02	4.278497e-01	3.601106e-01
246	2.577520e-02	-1.976147e-01	4.346719e-02	-6.292602e-01	1.931405e-01	2.666162e-01	5.426064e-01	-3.712054e-01	-3.960570e-03	-1.001059e-01	4.038020e-01	1.819512e-01
247	2.014314e-01	-2.662045e-01	-2.021015e-01	-6.374207e-01	3.396473e-02	4.676935e-02	1.812169e-01	-4.055774e-01	1.738854e-01	1.316213e-01	6.044121e-01	2.669654e-01
248	-3.120663e-01	1.569251e-01	1.844414e-01	-5.253238e-02	-5.015779e-01	-2.719431e-01	1.936054e-01	-3.033329e-01	-4.408493e-01	2.297629e-02	3.904889e-01	1.547584e-01
249	2.657452e-01	-3.503965e-01	9.492277e-02	-7.715663e-01	-3.339294e-01	2.487834e-02	3.011181e-01	-3.101313e-01	-4.669690e-02	-1.291429e-01	5.547811e-01	1.227492e-01
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251	5.692914e-01	-2.420279e-01	-3.712760e-02	-6.336366e-01	-1.741125e-01	1.188131e-01	3.316299e-01	-3.716579e-01	1.914772e-01	3.420517e-01	3.361074e-01	3.031785e-01
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253	-9.939212e-02	-1.380383e-01	-3.605338e-02	-6.366745e-01	9.567326e-02	4.732409e-02	4.081547e-01	-4.832657e-01	1.612995e-01	1.807191e-01	2.283211e-01	3.606154e-01
254	2.545922e-01	-7.557204e-03	-1.788833e-01	-6.395330e-01	-6.982309e-02	1.158085e-01	2.305193e-01	-5.521732e-01	1.573667e-01	6.661258e-03	-8.056686e-02	2.459837e-01
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256	2.382456e-01	-3.144025e-01	-6.638685e-02	1.754238e-01	-6.309236e-02	-3.342881e-02	-2.283350e-01	-3.357349e-01	3.709586e-02	-3.187335e-01	-7.022725e-02	-2.905478e-01
257	-5.680315e-02	-4.038426e-01	1.446544e-02	-8.395690e-01	1.503290e-01	-1.746386e-01	2.882806e-01	-6.354800e-01	7.023747e-02	-6.038399e-02	2.635516e-01	2.933656e-01
258	-8.406144e-02	-7.074195e-01	1.878475e-01	-7.913065e-01	-1.656407e-01	3.701762e-01	8.660678e-01	-1.384497e-01	-4.097188e-02	1.184603e-01	-5.108788e-03	-1.180233e-01
259	2.070236e-01	-7.353954e-01	7.879264e-02	-6.394629e-01	-5.149372e-01	4.865505e-01	5.038449e-01	-3.675363e-01	-5.711872e-02	3.009256e-01	-1.221550e-01	1.281247e-01
260	-5.495062e-01	-4.487907e-01	4.942105e-01	-5.624031e-01	1.019276e-01	1.345012e-01	9.032378e-01	-3.365785e-01	-3.933935e-01	-2.625959e-01	1.751132e-01	-9.536000e-02
261	-3.982677e-02	-1.361877e-01	3.684328e-01	-1.376203e-01	-4.394701e-01	8.814669e-02	1.909332e-01	7.555869e-02	-1.076183e-01	1.819543e-03	2.147141e-01	1.314439e-01
262	6.852964e-02	-6.086726e-02	2.865503e-02	-7.165644e-01	1.403774e-01	1.415662e-01	5.975283e-01	-2.979994e-01	2.846068e-01	3.094795e-02	4.636577e-01	3.336635e-01
263	1.051061e-01	-1.372562e-01	-3.196674e-02	-9.163283e-01	-9.620377e-02	-1.277029e-01	6.835454e-01	-1.890562e-01	1.138882e-01	2.684786e-02	2.916265e-01	-9.416956e-02
264	-5.508981e-02	-2.719910e-01	2.089750e-01	-8.067035e-01	1.596466e-01	1.859512e-01	9.180800e-01	-2.926562e-01	-8.659443e-02	-4.988430e-02	2.363351e-01	-3.980241e-02
265	2.027156e-01	-3.209140e-01	3.289877e-01	-8.013664e-01	-5.147161e-02	3.620581e-02	7.200685e-01	-5.741836e-01	-2.175483e-01	5.310633e-02	6.790610e-02	1.856833e-01
266	-1.607512e-01	-3.042467e-01	4.731424e-01	-4.290371e-01	-8.376533e-02	2.924149e-01	8.132012e-01	-5.988560e-01	-3.748098e-01	1.487346e-01	-2.122295e-01	2.256414e-01
267	-3.344741e-01	3.618769e-01	-3.071159e-01	-2.909506e-01	-2.159233e-01	2.935967e-01	8.624532e-02	-2.553036e-01	2.378291e-01	-7.079770e-02	2.146323e-01	3.609682e-01
268	-5.126418e-01	-5.959853e-01	3.403503e-02	-5.878620e-01	-1.130625e-01	-3.433430e-01	-2.726727e-01	-2.540574e-01	-1.486211e-01	-6.542152e-01	7.641029e-01	-3.246931e-02
269	-2.073780e-01	-8.959429e-02	8.888227e-02	-3.087818e-01	-4.923387e-01	2.178590e-01	3.128878e-01	-3.372521e-01	-5.709623e-02	-2.773498e-02	-3.247585e-01	7.397561e-02
270	4.375582e-01	1.313614e-01	1.233972e-01	-2.659019e-01	-2.604285e-01	-1.265916e-01	-6.305210e-02	3.314416e-01	2.788277e-01	-5.175605e-02	1.834948e-01	1.079875e-02
271	-3.325821e-01	6.542624e-01	-4.297495e-01	6.262978e-01	7.803748e-01	-4.850442e-01	-1.935791e-01	1.131233e-01	3.831939e-01	5.388260e-01	4.140843e-01	-4.393057e-02
272	-1.192955e-01	-7.197066e-01	-4.099779e-01	-3.045922e-01	-4.041434e-01	-2.229591e-02	-3.136253e-01	1.696321e-02	1.743909e-01	1.648768e-01	8.502321e-01	-9.327128e-02
273	-2.093254e-01	-6.863382e-02	1.695600e-01	-1.193746e-03	-5.629036e-01	6.629219e-02	4.345133e-02	-5.068138e-01	-3.240725e-01	2.180823e-01	-6.043562e-01	2.296314e-01
274	-2.820079e-01	-1.580416e-01	4.268381e-01	1.133615e-01	-4.560921e-01	3.178661e-01	8.105762e-01	-6.723571e-02	-4.451484e-01	4.432733e-01	-6.337276e-02	-1.801113e-01
275	-2.100960e-01	-1.422240e-01	6.505042e-01	2.295100e-01	-4.479628e-01	3.702907e-01	2.556932e-01	-1.954666e-01	-3.598484e-01	1.555279e-01	-1.113983e-02	3.102835e-01
276	2.391839e-01	-5.563434e-01	5.393048e-01	-8.380885e-01	4.718707e-01	3.121273e-01	7.225879e-01	4.165531e-01	1.014501e+00	2.414501e-01	5.993811e-01	2.754730e-01
277	3.356513e-01	1.171465e-01	-2.358650e-01	3.645311e-02	1.860038e-01	-8.374611e-02	-2.422651e-01	-3.624384e-01	3.099860e-01	3.265952e-01	9.146994e-01	5.605565e-01
278	1.167819e+00	4.391063e-03	-1.486406e-01	4.720518e-02	6.780334e-03	3.075036e-02	1.338453e-01	-2.348328e-02	1.507194e-01	5.868043e-01	-2.541174e-01	-3.085813e-01
279	2.553682e-03	-9.179857e-02	-1.410834e-01	-2.610018e-01	-6.630446e-01	-1.343717e-02	-8.222422e-02	-7.144253e-01	-4.644573e-01	-4.946750e-02	-3.611400e-01	4.509773e-02
280	-4.050934e-01	2.287357e-01	-1.832415e-01	5.803510e-02	-6.535933e-01	-1.526425e-01	1.077487e-01	2.925863e-02	-1.619491e-02	4.420232e-01	2.510409e-01	-4.630393e-03
281	4.039099e-03	-1.175355e+00	3.367595e-01	-1.089257e-01	-1.659111e-01	4.807706e-03	-8.144126e-01	-8.025408e-02	-2.530111e-01	-5.636504e-01	-2.306505e-01	-1.081266e+00
282	-8.287553e-02	-1.543109e-01	-5.100740e-03	-7.253329e-01	-5.809653e-01	9.376544e-02	2.293872e-01	-3.132501e-01	2.360530e-01	-1.064602e-01	-7.075334e-01	9.853959e-02
283	4.982769e-01	3.471265e-01	3.311645e-01	1.340794e-01	-6.152963e-01	3.560473e-01	5.868309e-01	1.423913e-01	6.384512e-02	7.068230e-01	-3.526845e-01	3.033530e-01
284	-2.531409e-01	-9.366035e-02	3.731954e-02	-3.485151e-01	-4.062453e-01	2.467309e-01	3.299522e-01	-3.601970e-01	-5.891673e-02	1.073158e-01	-5.350974e-01	2.074591e-01
285	-2.075657e-01	1.548031e-01	7.103022e-02	-1.446610e-01	-2.432630e-01	2.020084e-01	2.652580e-01	-4.760306e-01	1.921748e-02	1.693061e-01	-4.824643e-01	3.577197e-01
286	-1.154943e-01	-3.541656e-01	3.955598e-02	-6.626788e-01	5.157729e-01	1.306875e-01	3.876941e-01	-3.630072e-01	5.786601e-01	4.373355e-02	1.897352e-02	2.475503e-01
287	3.056628e-01	3.522507e-01	-2.123971e-01	1.501647e-01	-2.071363e-01	2.249484e-01	2.323422e-01	-6.422454e-01	-4.566983e-01	1.570413e-01	-4.044821e-02	3.284443e-01
288	-2.540950e-02	-4.552643e-01	4.305748e-01	-1.309771e-01	-5.286442e-01	1.639881e-01	1.749044e-03	-3.519807e-01	-4.949574e-01	-8.400055e-02	-6.710657e-02	2.683542e-01
289	2.583350e-01	5.954139e-01	-2.470778e-01	2.778443e-01	5.488597e-01	-7.122327e-01	-1.391896e-01	2.619358e-01	3.639340e-02	8.925541e-02	-1.062619e-01	-6.346368e-01
290	1.422091e-01	3.386254e-01	-2.899026e-01	5.485386e-01	1.378479e-01	-7.415763e-02	1.347991e-01	-1.131074e-01	-1.875212e-01	4.743709e-01	3.260773e-01	-5.062473e-01
291	-8.900293e-02	4.474229e-01	1.473677e-01	4.180120e-01	-2.871110e-01	1.810173e-01	-2.755482e-02	3.867316e-01	5.033816e-01	3.810863e-01	4.586178e-01	1.940933e-01
292	9.111744e-01	1.149496e-01	-5.631255e-01	-2.717085e-01	3.532301e-01	2.692820e-03	6.157816e-01	-2.368872e-01	-1.177194e-01	1.901424e-01	-2.301240e-01	-4.665569e-01
293	2.918453e-01	2.573083e-01	-1.868911e-02	8.623160e-02	-6.959422e-01	1.504938e-02	3.022178e-01	-1.137321e-01	-2.409868e-01	2.123312e-01	-3.761650e-01	1.940859e-01

294	3.958156e-01	-5.031124e-02	-9.620537e-02	-2.076774e-01	-2.866128e-01	1.875570e-01	3.140207e-01	-1.808033e-01	-8.384368e-02	3.675947e-01	7.038303e-02	2.196888e-01
295	2.975872e-01	1.559666e-01	-3.889752e-02	2.068284e-01	5.962304e-01	-7.892438e-01	3.517267e-02	6.899758e-01	3.094399e-01	6.755128e-01	2.606190e-01	-3.603687e-01
296	3.208597e-01	4.423501e-01	-5.895792e-02	-7.815803e-02	-5.457492e-01	3.602433e-01	-5.234259e-02	-8.352362e-02	-1.682400e-02	-1.684690e-01	-5.706356e-02	5.797814e-01
297	1.842674e-01	-9.545047e-02	8.898836e-01	-7.223459e-02	1.851526e-01	2.776459e-01	2.916809e-01	2.425955e-01	-1.390975e-01	-1.333441e-01	-1.449635e-01	-1.356655e-01
298	-6.166648e-02	1.799634e-01	-3.281756e-01	1.693758e-01	-1.383593e-01	-4.138112e-01	-2.425962e-01	-1.839180e-01	-1.561672e-01	2.512324e-01	2.514745e-01	-4.381279e-01
299	-3.250572e-01	1.959741e-01	-3.171201e-01	-1.433174e-01	-4.128444e-01	-1.944620e-01	-4.793541e-02	-1.796019e-01	-4.306974e-02	1.572072e-01	-2.491567e-02	-2.058508e-01
300	-2.760527e-01	4.517871e-02	1.892694e-01	3.743668e-01	-8.706779e-02	-6.224164e-01	-1.408158e-02	-1.023868e-01	-1.540416e-01	5.133468e-01	1.664241e-02	-1.738682e-02

Position Embedding Weight (Embedding_Dim = 12, Max_Seq_Len = 16)

1	2	3	4	5	6	7	8	9	10	11	12
4.158500e-01	-1.949988e-01	-2.365078e-01	-5.049745e-01	6.539327e-01	-1.880279e-01	-3.662106e-01	7.947314e-01	-7.564061e-01	-8.355716e-02	-5.895474e-01	1.046270e+00
1.674122e-01	1.569716e-02	-1.178682e-01	-5.914081e-01	6.567027e-01	5.364657e-03	-4.999004e-01	6.732099e-01	-1.132163e+00	1.209195e-01	-6.322204e-02	3.590975e-01
4.786139e-03	1.575054e-01	-5.974528e-02	-7.253161e-01	6.457813e-01	2.146142e-01	-5.515308e-01	3.551483e-01	-9.411322e-01	4.297113e-01	1.211590e-01	2.546982e-03
-1.250602e-01	2.967361e-01	5.686091e-02	-6.833055e-01	4.947201e-01	3.590525e-01	-5.146986e-01	9.919457e-02	-5.672447e-01	5.692165e-01	2.819290e-01	-1.820414e-01
-2.192527e-01	3.536757e-01	1.804120e-01	-5.881378e-01	3.160569e-01	4.051244e-01	-4.289742e-01	-1.023577e-01	-2.142949e-01	5.657954e-01	3.705807e-01	-3.119287e-01
-2.885894e-01	3.463786e-01	2.332268e-01	-4.749943e-01	9.062239e-02	3.183042e-01	-3.532475e-01	-2.845000e-01	4.701203e-02	4.558106e-01	3.607281e-01	-4.430472e-01
-3.017989e-01	3.069823e-01	2.691520e-01	-3.146965e-01	-1.182940e-01	2.086618e-01	-2.276500e-01	-4.526762e-01	2.926774e-01	3.068767e-01	3.329665e-01	-5.411173e-01
-2.936891e-01	2.442140e-01	2.877829e-01	-1.415950e-01	-2.879260e-01	1.106215e-01	-7.082754e-02	-5.692025e-01	5.513123e-01	1.509377e-01	2.755358e-01	-5.384153e-01
-2.508033e-01	1.803741e-01	2.541365e-01	6.244984e-02	-4.179104e-01	-7.482575e-03	9.093513e-02	-6.318926e-01	7.656417e-01	-2.201265e-02	2.160273e-01	-5.210577e-01
-1.592364e-01	1.155828e-01	2.215285e-01	2.887821e-01	-4.953842e-01	-9.287743e-02	2.494547e-01	-6.165589e-01	9.002618e-01	-2.093817e-01	1.480190e-01	-4.178449e-01
-3.176242e-02	6.278335e-02	1.588431e-01	4.983150e-01	-5.260979e-01	-1.993727e-01	3.947840e-01	-5.139300e-01	9.664299e-01	-3.867995e-01	5.838409e-02	-2.620399e-01
1.094573e-01	-1.215952e-02	7.999105e-02	6.715674e-01	-4.905423e-01	-2.928883e-01	4.987429e-01	-3.846574e-01	9.110691e-01	-5.497895e-01	-4.477762e-02	-8.966552e-02
2.351709e-01	-8.194827e-02	-4.140887e-02	8.269899e-01	-4.204212e-01	-3.872293e-01	5.650887e-01	-2.370369e-01	7.920983e-01	-6.879665e-01	-1.331920e-01	8.711663e-02
4.036961e-01	-9.087127e-02	-5.352523e-02	8.628485e-01	-3.711848e-01	-4.469160e-01	5.679197e-01	3.800835e-02	5.588811e-01	-7.940201e-01	-2.215289e-01	2.592809e-01
5.080879e-01	-7.730159e-01	-1.019610e+00	1.384328e+00	1.404163e-01	-1.174958e+00	1.200360e+00	2.330894e-01	2.409616e-01	-1.201913e+00	-4.999893e-01	1.060508e+00
2.333611e-01	-8.761143e-02	2.447063e-01	7.846642e-02	-1.016171e-01	1.668976e-01	-1.676541e-01	-1.728621e-01	2.888685e-01	-2.045751e-01	-8.318471e-02	-1.571816e-01

Layer 1

1. Calculate LayerNorm 1

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \widehat{x_i} = \frac{x_i - \boldsymbol{\mu}}{\sqrt{\boldsymbol{\sigma}^2 + \varepsilon}}\ (\varepsilon\text{=1e-5})$$

$$\boldsymbol{h_1} = \mathrm{LN}(x)_i = \boldsymbol{\gamma}_i\,\widehat{x_i} + \boldsymbol{\beta}_i$$

***** In this case, h1 has shape of (n * 12)

Masked MSA block Weight (γ_1)

1	2	3	4	5	6	7	8	9	10	11	12
6.175187e-01	1.020044e+00	1.007808e+00	8.669566e-01	7.341702e-01	1.133420e+00	8.829391e-01	1.102555e+00	9.235978e-01	1.039975e+00	7.770612e-01	9.110500e-01

Masked MSA block Bias (β_1)

1	2	3	4	5	6	7	8	9	10	11	12
5.107012e-02	2.985823e-01	3.019372e-02	3.707277e-01	1.328427e-01	9.781763e-02	7.925928e-02	4.113878e-01	-1.374485e-01	2.032842e-01	-2.752136e-02	3.073651e-01

2. Calculate Q,K,V, Multihead attention

$$\mathbf{Q} = \boldsymbol{h_1}\mathbf{W_Q} + \boldsymbol{b_Q},\ \mathbf{K} = \boldsymbol{h_1}\mathbf{W_K} + \boldsymbol{b_K},\ \mathbf{V} = \boldsymbol{h_1}\mathbf{W_V} + \boldsymbol{b_V}$$

*Perform a single 12×12 multiplication. (You can also compute by splitting into n*12)

Masked MSA Multihead Attention block *in* Q, K, V weight (3 heads)

Query Weight											
-2.792495e-01	3.953977e-02	3.542362e-02	6.315130e-03	-1.026617e-01	-2.668245e-01	-5.189547e-01	-2.565697e-01	5.204406e-01	-1.021446e-01	7.447452e-01	-5.499777e-01
1.331214e-01	-1.706550e-01	1.224960e-01	3.754453e-01	-1.954252e-01	-1.099524e-02	2.956457e-01	-6.418976e-01	1.635166e-01	-1.864894e-01	-9.323798e-02	-3.868453e-01
-1.411523e-01	-4.861955e-01	-1.484299e-01	-2.628005e-01	3.561212e-01	-4.165637e-01	-1.246645e-01	-1.331307e-01	9.420021e-02	7.773160e-01	-1.914929e-01	-1.826165e-01
7.832651e-02	-3.660667e-01	4.445374e-02	-4.951328e-01	-1.872689e-01	-1.628078e-01	3.260820e-01	-5.164062e-01	-4.193489e-02	-1.586417e-01	2.338347e-01	1.090866e-01
1.729054e-01	-2.158219e-01	-1.979380e-01	3.485445e-01	-6.498058e-02	-4.169164e-01	1.962307e-01	3.627300e-02	-8.858197e-02	-9.346192e-02	-5.862533e-02	5.172705e-02
1.103347e-01	-4.045927e-01	-1.976134e-01	-1.863195e-01	8.715877e-02	-2.712499e-02	2.647068e-02	-1.769116e-01	-2.207567e-01	-2.643707e-01	2.605434e-01	1.753810e-02
-2.410164e-01	-2.876242e-01	-3.390498e-01	3.006831e-01	-2.714058e-01	-4.627088e-02	2.295026e-01	-5.067369e-03	3.500806e-01	-3.360635e-01	-6.319542e-03	3.214221e-02
5.754248e-02	-8.645325e-03	2.289879e-01	1.074458e-01	-2.436539e-01	1.759983e-02	2.078451e-01	-5.085326e-01	2.499482e-01	-1.311746e-01	1.556632e-01	-4.525951e-01
-1.291546e-01	1.583614e-01	2.222372e-01	-1.217829e-01	1.233119e-02	-1.475831e-01	3.290968e-02	-2.722454e-01	-2.101508e-01	1.802560e-01	8.568320e-02	-1.887693e-01
1.825411e-02	-1.910424e-01	-3.104821e-01	2.241029e-02	-7.294647e-02	-3.353969e-01	1.521154e-01	1.256861e-01	-9.248365e-02	-1.575136e-01	-2.661091e-02	3.113283e-01
1.243564e-01	1.954755e-01	-5.468297e-02	-3.325458e-01	3.234053e-01	2.088389e-01	-1.999294e-01	5.582091e-01	-4.011239e-01	4.179322e-01	-1.356594e-01	3.355571e-01
-1.461634e-01	-1.536093e-01	2.298509e-01	-2.634102e-01	-2.240231e-01	7.712372e-02	-4.240536e-01	-1.070358e-01	2.424098e-02	-6.747273e-02	-9.508153e-02	-4.966296e-01
Key Weight											
-7.032716e-01	1.093499e-01	1.896074e-01	1.572291e-01	-9.936372e-02	-2.249519e-01	-1.039722e-01	-5.712576e-01	6.758159e-01	1.684140e-02	5.759029e-02	2.550745e-01
2.152955e-01	-4.537740e-01	-4.698764e-02	4.539201e-01	-2.128524e-01	-4.583617e-01	6.789792e-01	-1.546418e-01	3.982602e-01	-3.084548e-01	-2.645471e-02	1.820333e-02
3.437873e-03	-3.250760e-01	3.627523e-01	-9.012647e-02	5.036770e-01	5.314283e-02	-3.153650e-01	-5.859272e-01	-1.809361e-01	-3.195641e-01	6.763883e-01	-8.823578e-02
2.682933e-01	-4.704495e-01	-5.198516e-01	-1.592912e-01	4.246598e-01	-2.452989e-01	-9.135675e-02	-1.163367e-01	3.423918e-01	5.793197e-02	4.187952e-01	3.055103e-01
2.120039e-01	-1.722056e-01	-2.604557e-01	3.062814e-01	-2.449265e-01	-1.618424e-01	4.062946e-01	5.649540e-02	6.853672e-02	-2.761923e-01	-1.995293e-01	1.974432e-01
-7.448874e-02	2.933140e-01	4.356859e-02	-2.304727e-01	-4.279252e-01	-4.410567e-01	3.364206e-01	-3.124151e-02	4.714936e-02	2.621034e-01	-2.944664e-01	3.300493e-01
-1.388859e-01	-1.517586e-01	-8.341229e-02	3.166132e-01	-1.960111e-01	-3.040619e-01	2.132628e-01	-1.432710e-01	4.513142e-01	-2.260285e-01	1.092601e-01	1.090887e-01
-1.162943e-01	8.464699e-02	1.964041e-01	3.160956e-01	-2.842618e-01	1.685001e-01	1.343239e-01	-4.987705e-01	4.270934e-01	1.458530e-01	9.217408e-02	-6.692948e-01
2.035015e-01	3.150247e-01	4.465348e-01	-4.592846e-01	1.922341e-01	-2.009263e-01	-3.179545e-01	-6.629802e-02	-1.895987e-01	-2.728598e-01	3.462494e-01	1.416076e-01
1.681152e-01	7.429418e-02	-3.285249e-01	1.915191e-01	1.580143e-01	-5.093717e-01	2.923319e-01	8.335689e-02	-2.546118e-01	-2.491655e-01	3.010071e-02	2.247480e-01
1.852761e-01	-2.676605e-01	-1.480981e-01	6.496824e-02	7.861305e-02	9.052855e-01	-2.647865e-01	3.378736e-01	-5.535348e-01	-2.289393e-01	-1.401489e-01	7.166484e-02
-7.280927e-02	3.991065e-01	3.540847e-02	-4.231727e-01	2.387370e-01	-1.508976e-01	-1.956227e-01	-1.033321e-01	6.274411e-02	2.709376e-01	7.193717e-02	-8.705443e-02
Value Weight											
-4.760642e-02	1.153213e-01	2.888625e-01	-1.532473e-01	1.596577e-01	1.338508e-01	-1.650820e-02	-7.358602e-02	-5.258554e-02	-1.553292e-01	6.665179e-02	1.039752e-01
-3.108766e-02	-1.044388e-01	4.171821e-02	1.026634e-01	1.794530e-01	-1.026676e-01	2.323950e-02	-1.219923e-01	1.005323e-01	9.940047e-03	1.536721e-01	2.925911e-02
-3.769203e-01	2.933545e-01	4.533527e-01	-3.314814e-02	1.134705e-01	1.887563e-01	-1.306248e-01	-3.535120e-01	-1.680150e-01	-8.878160e-02	4.180366e-01	-3.910843e-02
1.791872e-02	1.356270e-01	4.511670e-01	-1.391735e-01	5.269162e-02	-2.949315e-03	-2.769011e-01	-2.182507e-01	-8.016232e-04	-1.167188e-01	2.962922e-01	2.228689e-02
-7.002337e-02	-3.489582e-01	-6.743068e-02	-1.019152e-01	2.113149e-01	-1.670513e-01	-5.437221e-02	1.103952e-01	-1.152873e-01	-9.282544e-03	-2.018562e-01	-3.190120e-02
7.436498e-02	3.393827e-01	-1.131088e-01	-9.822752e-02	-1.813683e-01	9.692207e-02	-1.065122e-01	-8.921663e-02	-1.515985e-01	1.967913e-02	5.358198e-02	1.833280e-01
-6.869946e-02	-2.391681e-02	1.122617e-01	-1.346641e-01	7.441692e-02	7.294011e-02	-1.414108e-01	1.083032e-01	-5.647025e-02	-4.571600e-03	1.289537e-01	-4.711917e-02
-9.999207e-02	-1.704070e-02	7.774289e-02	-9.631440e-02	4.171303e-02	1.958076e-01	-9.364770e-02	-1.285449e-01	-2.437167e-02	1.350189e-01	-5.160280e-02	-2.946573e-01
2.538922e-02	1.281845e-01	1.491838e-01	-3.899211e-02	4.511770e-02	8.468506e-02	7.884675e-02	-1.338072e-01	1.579389e-01	1.853745e-01	-4.679220e-02	-6.851358e-02
2.418706e-02	-1.254606e-01	-5.347631e-02	1.187408e-01	2.143664e-02	-1.267350e-01	-3.065812e-02	-1.201589e-01	8.379860e-03	-1.217897e-01	-1.588612e-01	-4.209636e-02
-8.204520e-02	-9.613573e-02	-2.129527e-01	4.803011e-02	-2.823481e-01	6.728744e-02	1.634807e-01	6.039409e-03	-9.135426e-03	-1.686017e-01	-1.132802e-01	9.978408e-03
-1.102383e-01	-5.171299e-03	1.004393e-01	9.367552e-02	-1.836075e-01	-7.221987e-02	1.689304e-01	4.228823e-02	1.230265e-01	-6.336271e-02	2.144309e-01	7.796630e-02

Masked MSA Multihead Attention block *in* Q, K, V bias

Query Bias											
-2.613653e-01	-8.790769e-02	-4.019997e-01	-8.936365e-01	-2.178935e-01	-5.322961e-01	-1.492995e-01	-3.010020e-02	-2.744495e-01	-3.917830e-01	6.259365e-01	-6.141562e-01
Key Bias											
-5.541956e-03	-1.078536e-01	-6.014297e-02	-5.414705e-02	1.955501e-02	2.172704e-01	-6.367262e-03	-3.093931e-02	2.994608e-02	-8.932211e-02	1.152926e-02	2.426405e-02
Value Bais											
9.739690e-02	1.016206e-01	3.195527e-02	8.656941e-02	-1.825441e-01	-1.237254e-01	-4.931368e-02	-1.112436e-01	7.801253e-02	-5.483798e-03	-5.830943e-02	8.546195e-02

$$\text{QK Score} = \frac{QK^T}{\sqrt{d_k}} \Rightarrow \text{Casual Mask(Upper triangle)} \Rightarrow A = \text{softmax} = \frac{exp(QKScore)}{\sum \text{exp(QKScore)}} \Rightarrow Attention\ Score = A \cdot V$$

*In this case, Multihead(Q,K,V) has shape of (n * 12)

If you calculate with 3 divided heads, you need to concat each heads.

$\mathbf{head_i = A_i V_i,\ i = 1, 2, 3}$ **Multihead(Q,K,V) = Concat(**$head_1, head_2, head_3$)

3. Calculate attn_out score

$$\text{attn_out} = \text{Multihead(Q,K,V)} \cdot W_O + b_O$$

Masked MSA Multihead Attention block *out* weight (W_O)

1	2	3	4	5	6	7	8	9	10	11	12
2.296920e-01	6.337877e-02	1.988660e-01	1.199686e-01	6.091955e-03	-2.289907e-02	4.795380e-02	-5.835060e-02	-3.241669e-02	-5.748540e-03	2.022160e-01	-8.187824e-02
2.224511e-01	1.179493e-01	1.249893e-01	1.687535e-01	-2.020105e-02	-5.463995e-02	3.164335e-01	4.339921e-04	-2.958499e-02	-1.810687e-01	-1.212703e-01	-2.558562e-02
-9.392462e-02	1.927584e-01	1.922287e-01	1.957741e-01	-5.997881e-02	-1.180053e-01	3.956347e-02	2.104219e-02	-1.355107e-01	-1.365213e-01	-3.404369e-03	1.645151e-01
2.258604e-01	-6.877765e-02	1.588061e-01	1.089525e-01	2.567744e-02	-1.991557e-01	-6.356298e-02	-1.287074e-01	1.506761e-01	2.260825e-01	1.429993e-01	3.667868e-02
1.698860e-01	-2.087757e-01	2.226186e-01	4.569338e-02	2.910604e-01	-1.258384e-01	2.480363e-02	1.703122e-01	-4.338131e-02	1.424514e-01	1.140026e-01	-3.250392e-01
1.535334e-03	9.692797e-02	1.956073e-01	1.145139e-01	6.508366e-02	-6.817421e-02	1.412480e-01	2.320696e-01	-5.574000e-03	-1.311437e-01	-1.104528e-01	-1.698209e-01
5.627479e-02	2.054298e-02	1.961335e-01	3.335799e-02	1.277968e-02	-2.502251e-01	-6.837761e-02	-8.888113e-02	-9.257112e-02	-2.723962e-02	1.321969e-01	1.746046e-01
1.336287e-01	2.301398e-02	2.115751e-01	4.563403e-02	3.851434e-02	-7.542416e-02	1.090383e-01	-2.539386e-01	-2.188720e-01	9.637687e-02	2.056393e-01	-1.507020e-02
5.354102e-02	3.044952e-01	1.869746e-01	2.930542e-02	-6.189694e-02	-3.378853e-01	-7.500225e-02	1.221219e-01	1.197681e-01	9.214049e-02	-1.094512e-01	2.967557e-02
1.301843e-01	-1.171548e-01	1.505906e-01	2.119444e-01	2.735528e-01	-5.948799e-02	1.365253e-01	1.652365e-01	3.995057e-04	-1.394250e-01	-2.518052e-02	-1.761882e-01
1.640473e-01	-4.663282e-02	1.737370e-01	9.680154e-02	1.034575e-01	-7.983501e-02	1.790202e-01	1.707492e-01	9.976751e-02	-4.113890e-02	-7.733175e-02	-1.301939e-01
9.537873e-02	2.494660e-02	1.235056e-01	1.608102e-01	1.520736e-01	-1.373051e-01	-4.109162e-02	-2.258032e-01	-2.315932e-01	3.257933e-01	6.243302e-03	-2.326884e-02

Masked MSA Multihead Attention block *out* bias (b_O)

1	2	3	4	5	6	7	8	9	10	11	12
3.860737e-02	7.282480e-02	7.049787e-02	6.551839e-02	-2.906172e-02	4.279015e-02	-6.398575e-02	-1.357106e-02	1.069346e-01	-4.720674e-02	-6.364526e-02	-7.774815e-02

4. Residual Connection

$$\text{input_x2} = \text{attn_out} + \text{input_x}$$

(in this case, input_x is position embedded matrix)

5. Calculate LayerNorm 2

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \widehat{x_i} = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}\ (\varepsilon\text{=1e-5})$$

$$\boldsymbol{h_1} = \mathrm{LN}(x)_i = \boldsymbol{\gamma_2}\,\widehat{x_i} + \boldsymbol{\beta_2}$$

***** In this case, h1 has shape of (n * 12)

MLP block Layer Norm weight(γ_2)

1	2	3	4	5	6	7	8	9	10	11	12
9.946589e-01	1.202689e+00	1.260670e+00	1.052192e+00	1.181151e+00	1.176190e+00	1.104370e+00	9.938747e-01	9.886096e-01	9.084116e-01	1.228172e+00	1.021777e+00

MLP block Layer Norm bias(β_2)

1	2	3	4	5	6	7	8	9	10	11	12
5.375889e-01	-5.733227e-02	7.314308e-01	2.938749e-01	7.507070e-02	-2.391119e-01	-7.325138e-01	-1.814895e-01	3.447169e-01	-7.763035e-01	-1.837611e-01	-2.451412e-01

6. Calculate First MLP Layer

$$\boldsymbol{h_3} = \boldsymbol{h_2 W_1} + \boldsymbol{b_1}$$

*In this case, h3 has shape of (n * 48)

First MLP Layer Bias (b_1, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-1.939433e-01	-6.600589e-02	4.450232e-02	-2.548952e-01	-1.247528e-01	-1.722536e-01	-3.477310e-01	-1.982095e-01	-3.977574e-01	-6.903913e-02	-5.716963e-02	-3.044240e-02
-2.085882e-01	-6.547067e-02	-1.435132e-01	-5.728777e-01	-2.649985e-01	-3.262985e-01	-1.308431e-01	4.957111e-03	-5.522528e-01	-1.875569e-02	-2.766736e-01	-5.985761e-02
-2.865958e-01	-1.954991e-01	-2.674843e-01	-3.395607e-01	-1.938981e-01	-1.505516e-01	-1.464152e-01	-4.963903e-01	-1.783533e-01	-3.756034e-01	-4.926806e-01	-2.536334e-01
-3.457421e-01	-3.486527e-01	-1.775814e-01	-1.570985e-01	-4.541936e-01	-3.809987e-01	-4.883842e-01	-9.827219e-02	-2.235727e-01	-2.040592e-01	-1.881442e-01	-3.684056e-01

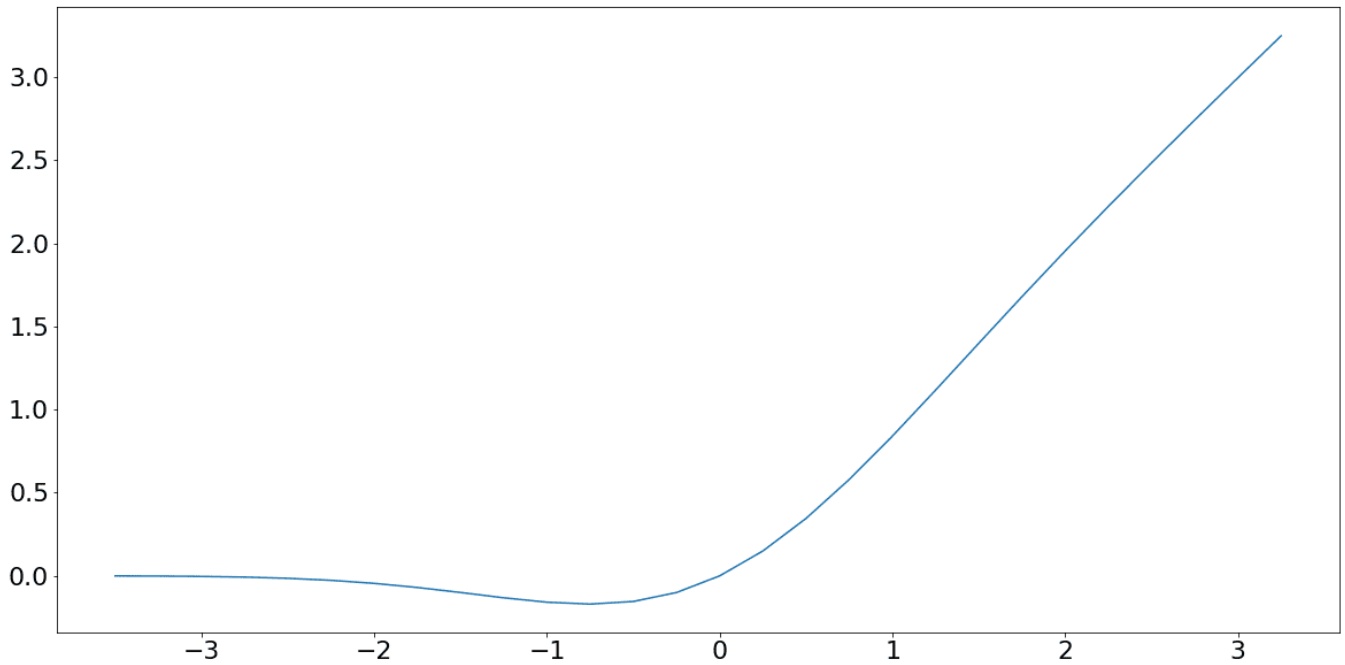
First MLP Layer Weight (W_1, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
8.436242e-02	3.309907e-01	-1.265323e-01	-2.651952e-01	-3.214999e-01	-3.440635e-02	1.452881e-01	2.584947e-01	-3.219152e-02	3.791124e-02	-2.535067e-01	-5.427764e-02
-4.236160e-01	-1.756311e-02	-2.493714e-01	1.163731e-01	-1.731601e-02	6.124616e-02	-1.197602e-01	7.832584e-02	-1.788122e-01	3.760832e-01	3.047084e-01	4.465086e-02
-2.900081e-02	-5.756255e-01	-5.350589e-02	-6.699180e-02	-1.349073e-01	5.446093e-01	5.149246e-01	-2.345226e-01	-1.800599e-01	1.063341e-01	1.473295e-01	1.730854e-01
3.898960e-01	2.742361e-01	-4.173667e-01	-2.260616e-01	-4.995226e-01	2.614065e-01	3.599948e-01	-2.474554e-01	-1.013411e-01	4.085613e-01	-3.885469e-01	1.321718e-01
-1.324084e-01	-7.414284e-02	-1.979880e-01	4.842538e-02	2.852807e-01	2.340987e-01	-7.818210e-02	-3.062958e-02	-3.729198e-01	-7.393245e-02	2.877381e-01	1.664144e-01
-4.665755e-02	5.150911e-02	-3.290243e-01	-4.857787e-01	1.371431e-01	-3.366507e-01	2.897084e-01	4.581787e-02	2.329867e-01	8.467928e-02	-2.547471e-01	4.186167e-01
-5.484579e-02	-8.798543e-02	2.961327e-02	1.997106e-01	6.723101e-02	-7.130204e-02	1.645843e-01	-2.271231e-01	8.125836e-02	1.507227e-01	1.442054e-01	-1.410967e-01
-3.327148e-01	4.385493e-02	1.186493e-02	-2.641042e-02	8.634736e-02	-4.637570e-02	2.633547e-01	1.044967e-01	-3.190723e-01	1.597306e-02	4.701901e-01	-1.922013e-01
-1.998999e-01	-2.227454e-03	-5.759092e-01	3.131253e-01	-3.590923e-01	2.813629e-01	3.118961e-01	5.652592e-03	1.310062e-01	2.597118e-01	-2.959660e-02	-1.362516e-01
-5.675757e-01	4.498365e-01	-5.833562e-01	9.857069e-02	1.513211e-01	2.417411e-01	4.561372e-01	2.072976e-02	-1.520061e-01	-1.479705e-01	-6.437214e-02	1.546058e-01
1.393756e-01	-2.216481e-01	-2.565475e-01	5.613055e-02	-6.856796e-02	3.502362e-02	1.574306e-01	6.347455e-02	6.152899e-03	-9.735055e-02	1.611977e-01	1.149917e-01
-7.343953e-01	-3.287280e-01	5.186075e-02	1.892108e-05	2.081991e-01	2.396640e-01	2.150088e-01	8.327222e-02	2.074582e-02	2.672257e-03	2.853460e-01	-4.333633e-02
-6.064786e-01	-1.668649e-01	2.134058e-01	-2.062263e-01	1.315666e-01	-4.273135e-01	1.263544e-01	5.349827e-02	2.869838e-01	6.223165e-01	-2.495210e-01	1.313756e-01
-1.315151e-01	3.338518e-01	4.980007e-02	-1.324761e-01	-1.530018e-01	-3.176527e-01	3.691591e-01	-3.230503e-01	-3.084138e-01	3.051152e-02	5.165936e-01	4.568247e-01
-4.368032e-01	-3.844838e-01	-6.961854e-02	5.416688e-02	-1.371919e-01	-1.582561e-01	-1.258470e-01	4.193279e-01	1.998897e-01	1.820073e-01	3.419287e-01	-4.240986e-02
-1.813686e-02	-4.012248e-01	-1.861254e-02	-1.426992e-01	1.305710e-01	-3.882874e-01	5.469626e-01	-2.056633e-01	1.891843e-01	1.058144e-01	2.249481e-01	3.290791e-01
1.045914e-01	4.562384e-02	-5.551332e-01	7.419242e-02	3.591939e-02	-1.996097e-01	1.212227e-01	2.791586e-01	2.484992e-01	4.041847e-01	-3.765473e-01	-2.993769e-01
-2.940661e-01	1.794049e-01	-1.825147e-02	-2.881805e-01	3.746618e-01	-9.625448e-02	1.297163e-02	-3.504250e-01	7.191411e-02	5.565679e-01	-7.489312e-02	1.592441e-01
-5.556252e-01	-3.279289e-01	4.043823e-01	-1.646459e-01	-1.450002e-01	1.133863e-01	8.272319e-02	-2.617103e-02	-2.524227e-01	6.365429e-01	-2.736633e-01	2.060419e-01
-3.921773e-02	-3.201829e-01	-1.674886e-01	-1.276855e-01	2.407494e-01	1.808373e-01	1.944759e-01	-9.357739e-02	-1.724226e-01	1.555841e-01	3.581393e-01	-8.495566e-02
-1.668880e-01	-3.012202e-01	-6.258541e-01	2.280522e-01	-2.164889e-01	4.510711e-02	4.815871e-01	4.540892e-01	-5.490097e-01	1.618315e-01	2.239391e-01	1.159388e-01
1.283136e-01	-2.799305e-01	-3.528995e-01	-1.188580e-01	1.278552e-01	-9.804433e-02	1.572390e-01	3.374718e-02	-3.273756e-01	1.676381e-01	1.030858e-01	4.547871e-01
1.515785e-01	1.390864e-01	1.687809e-01	-1.559472e-01	-2.032881e-01	-2.518319e-01	1.572952e-01	1.419582e-01	-6.441288e-02	2.346644e-01	-2.714113e-01	-2.405868e-01
9.742393e-02	1.423411e-01	-2.831687e-01	7.605757e-02	1.981246e-01	-1.621979e-01	5.578078e-02	-1.617742e-01	6.618115e-02	9.570550e-03	1.634017e-01	-3.963638e-02
-5.031434e-01	5.474340e-02	7.623224e-02	1.073860e-01	1.705824e-01	-4.008250e-01	1.362696e-01	5.402452e-02	-1.550738e-01	1.036302e-01	-3.362033e-01	4.887702e-01
2.402918e-01	-2.831787e-02	-4.302533e-01	-6.529351e-01	-1.488736e-01	-3.935062e-01	5.067838e-01	-4.981291e-01	2.212420e-01	6.276122e-01	-2.664607e-01	4.270675e-01
-8.451793e-02	-2.836623e-01	-2.211105e-01	2.555338e-01	-3.626899e-02	-1.811786e-01	3.030118e-01	4.407173e-02	-1.119238e-01	1.513394e-01	4.947774e-02	1.139735e-01
-3.310524e-01	-1.120889e-01	-4.039589e-01	9.325964e-02	1.597526e-01	6.918777e-02	3.420039e-01	1.739441e-01	-2.137030e-01	5.610002e-01	-3.278339e-01	-6.197254e-02
-1.046591e-01	-5.591857e-01	-2.915517e-01	7.990949e-03	-4.935871e-01	1.145130e-01	2.145667e-01	4.465586e-01	-2.617370e-02	3.684376e-01	3.502481e-01	-3.702616e-01
-1.223959e-01	-1.559641e-01	-1.924631e-01	4.737774e-02	7.968221e-02	-1.238088e-01	8.226332e-02	-3.473532e-01	2.176723e-01	8.794463e-02	1.304451e-01	5.465212e-02
1.149821e-01	1.312566e-01	-1.179414e-01	-4.557660e-01	-9.455644e-02	-2.476642e-01	-3.457024e-02	-1.286415e-01	6.290696e-02	3.010890e-01	2.839037e-01	2.382153e-01
-5.715172e-01	-6.342787e-02	1.378344e-01	-4.307114e-01	4.782599e-01	-1.264658e-01	2.545918e-01	2.228056e-02	1.933319e-01	5.975672e-02	-1.612204e-01	-3.095476e-02
-2.394171e-01	1.355426e-02	3.026398e-01	-2.596408e-01	-1.155191e-01	-1.978993e-02	3.461849e-02	9.761143e-02	1.070790e-01	4.647217e-02	-1.671818e-01	1.354898e-01
3.035323e-01	2.117587e-01	-6.510899e-01	-4.610320e-01	-1.454162e-01	3.444099e-02	3.396882e-01	4.192800e-02	-6.470449e-02	5.821052e-01	-1.316472e-01	3.122640e-03
-4.008213e-01	-3.051759e-01	-4.384631e-02	-2.719060e-01	4.931313e-01	-3.663092e-01	2.745726e-01	8.088339e-02	-1.736562e-01	2.618106e-01	1.062870e-01	1.222070e-01
1.643039e-01	-3.724553e-01	-1.107644e-01	-1.929343e-01	2.682650e-01	-2.773132e-01	3.199480e-01	-1.897439e-02	-6.125842e-02	2.492445e-01	-2.471695e-01	3.721015e-01
-2.082109e-01	-6.961525e-03	4.622136e-02	-4.262011e-01	-2.824389e-02	1.563046e-01	-1.533788e-02	1.671271e-01	-2.772513e-01	1.783076e-01	2.585746e-01	1.895407e-01
-2.328182e-01	2.664538e-02	-8.120240e-01	2.781328e-01	-1.059401e-01	1.421564e-01	1.194517e-02	-3.724723e-03	-9.860758e-02	4.200060e-02	-1.065772e-01	3.949641e-01
2.124165e-01	3.685976e-02	-2.170440e-02	9.126296e-02	-1.956812e-02	5.587420e-02	3.666870e-02	-1.176983e-01	-1.141773e-01	-6.363793e-02	6.362675e-02	-6.592344e-02
8.796211e-02	2.110506e-01	-5.623729e-01	2.130861e-01	-6.119412e-01	1.247668e-01	-4.163024e-02	1.496015e-01	1.906191e-02	6.597185e-01	-3.538654e-01	7.067129e-02
-3.085080e-01	2.017810e-01	-1.896604e-01	-7.997660e-02	-8.013204e-02	3.245280e-01	-1.394667e-01	7.840837e-02	-1.596369e-01	4.205556e-01	2.405025e-02	1.153224e-01
3.113872e-02	5.161632e-01	-1.110522e-01	1.374907e-01	-2.208991e-01	1.207914e-01	1.990836e-01	-2.339947e-01	-3.320372e-01	-1.298524e-01	-8.654768e-02	1.301954e-01
-1.781198e-01	-6.202097e-01	-6.190566e-01	-2.829090e-01	-1.314551e-01	5.573395e-01	3.757187e-01	2.282092e-01	-1.193636e-01	1.328459e-01	1.013410e-01	4.039651e-01
2.272227e-01	-5.370199e-02	-3.482796e-01	2.088702e-01	-1.610741e-01	-7.535093e-02	-2.137721e-01	-4.376637e-02	-1.427649e-02	1.271417e-01	3.263238e-01	-4.873639e-02
1.060271e-01	-3.304012e-02	1.253234e-01	-1.949458e-01	6.114651e-02	-6.888904e-02	5.752788e-02	-1.463081e-01	6.645042e-02	3.378450e-02	5.673198e-02	5.444355e-02
-3.274714e-01	2.569616e-01	-6.314697e-01	2.964568e-01	-3.315138e-02	3.178645e-01	-3.132708e-02	-1.447907e-01	1.065161e-02	1.798558e-02	-9.071746e-02	1.105964e-01
8.087170e-02	4.283916e-02	-1.692761e-01	-1.527408e-02	-3.880201e-01	3.599030e-01	3.163265e-02	-1.571790e-02	-5.573195e-02	-1.948499e-02	5.800559e-03	7.443554e-02
-3.322576e-02	-7.668363e-02	4.391302e-03	4.457314e-02	6.902912e-02	-1.865077e-01	2.451347e-01	-2.352315e-01	1.630179e-01	1.006368e-01	1.530121e-01	-4.634706e-02

7. GELU Activation Function

$$\boldsymbol{h_3 = GELU(h_3)}$$

*In this case, h3 has shape of (n * 48)



8. Calculate Second MLP Layer

$$\boldsymbol{h_4} = \boldsymbol{h_3 W_2} + \boldsymbol{b_2}$$

Second MLP Layer Weight (W_2, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-1.213444e-02	-2.560442e-02	-1.296355e-01	-4.750964e-02	3.313500e-02	7.362746e-02	1.061464e-02	-1.556941e-02	-6.097750e-03	-5.830389e-02	6.252193e-03	1.966351e-02
-4.637607e-04	-5.889318e-03	6.976106e-03	1.471722e-02	-4.720849e-02	5.601250e-02	1.497123e-03	1.796211e-02	-2.439483e-02	9.334974e-03	-4.527332e-02	8.215222e-02
2.132443e-02	2.836684e-02	-1.825298e-03	-7.288171e-02	-1.198584e-01	1.304639e-01	3.324714e-02	1.239136e-02	1.433019e-02	5.437090e-03	4.850045e-02	-1.141646e-02
2.963030e-02	2.235129e-02	-7.192482e-02	-9.468318e-02	1.767868e-02	-1.958123e-02	-2.233563e-01	3.614733e-02	-2.498970e-02	-4.164165e-03	-2.758539e-02	5.424226e-02
-1.011985e-02	-1.609649e-02	-6.444969e-02	-1.773528e-02	2.599816e-02	1.937222e-02	-3.847656e-02	-2.368219e-03	-3.848630e-03	1.021726e-01	-2.176211e-02	1.048156e-02
6.443524e-02	-4.622979e-03	1.181081e-02	-3.460309e-02	4.945514e-02	3.928671e-02	7.688870e-03	-5.173412e-02	1.224990e-01	1.932821e-02	-1.831774e-02	-2.752065e-02
-3.072220e-02	5.305245e-02	-4.997607e-02	1.280877e-01	-7.324868e-02	7.455754e-02	2.207023e-02	-6.917061e-04	9.177978e-02	2.599231e-03	-1.788883e-03	-1.527644e-02
-4.246535e-02	4.900618e-02	-9.267459e-02	-8.310817e-02	-1.590522e-03	-4.825322e-02	-9.543427e-02	-8.565620e-02	5.905624e-02	2.401935e-02	-6.965755e-02	1.549458e-03
2.354755e-03	2.081824e-02	1.242643e-02	8.642969e-02	-2.080328e-03	4.747489e-02	5.063703e-02	3.204806e-02	-8.325088e-02	-9.098602e-02	-3.326432e-02	2.429927e-02
5.935346e-03	7.564881e-02	3.348223e-02	-1.510638e-02	1.027500e-01	4.790459e-02	1.060797e-02	4.192135e-02	1.773575e-01	7.807672e-03	-2.540824e-02	2.002003e-01
-3.367737e-02	8.217344e-02	-3.966207e-02	-5.742734e-02	2.622062e-02	9.817603e-02	-1.055496e-02	1.168178e-02	-1.289250e-01	-5.676615e-02	4.886152e-02	-1.141741e-01
-3.248290e-02	-1.618647e-02	4.203472e-02	3.782574e-02	-4.514301e-02	9.900612e-02	1.659463e-01	7.524665e-02	6.933031e-03	1.167240e-02	-2.732407e-02	8.144605e-02
-9.073242e-02	-2.223555e-02	-1.978372e-02	-1.910037e-02	7.574432e-02	9.017090e-02	-2.300122e-02	-1.503695e-02	2.792281e-02	7.670284e-02	-6.244530e-03	-6.038661e-02
2.092080e-02	-4.125335e-02	-1.391687e-02	5.681013e-02	1.971407e-02	-2.477131e-02	-4.943774e-02	-7.979786e-02	-3.886707e-02	-3.575992e-02	-3.947770e-02	-9.063906e-02
1.777359e-02	4.833169e-02	-3.018437e-03	-9.014110e-02	-1.763904e-02	-3.198446e-03	-5.991722e-02	-3.123188e-02	7.082096e-02	-2.622858e-02	-7.380892e-02	3.483795e-02
7.965795e-02	4.174212e-02	-1.080820e-02	-1.075109e-01	2.854828e-03	-2.884857e-02	-1.706638e-01	-3.632495e-02	-2.726148e-02	7.912206e-03	5.253421e-02	2.275384e-02
2.658343e-03	-4.567225e-02	7.746952e-02	-2.192625e-06	-4.175438e-02	3.501082e-02	-1.141600e-01	3.096087e-02	-5.327808e-02	-1.824977e-02	4.625499e-02	1.544971e-02
1.918781e-03	1.307161e-02	4.342364e-02	-3.265312e-02	1.171634e-02	-1.330958e-03	6.351086e-02	-1.094283e-02	6.618196e-02	-1.403272e-01	5.925931e-02	-3.983191e-02
5.423132e-02	1.789970e-01	9.366560e-02	-1.654957e-01	6.325032e-02	-7.844118e-02	2.668956e-02	4.082812e-02	2.905945e-02	6.629589e-02	8.699793e-02	6.655171e-02
4.730103e-03	1.831435e-02	2.846360e-02	-4.063052e-02	-8.855050e-03	2.424954e-02	5.723594e-03	-1.564537e-02	2.250986e-02	-4.701614e-02	4.022622e-02	-8.163828e-02
4.844698e-03	-2.033100e-02	-2.753379e-02	-3.638111e-02	1.062591e-02	5.614243e-02	-7.820335e-03	2.134311e-02	-3.015246e-02	-2.358981e-02	-1.110693e-02	-2.097776e-02
1.228057e-01	7.341467e-02	-2.326784e-02	-8.406099e-02	-3.211554e-02	-3.537943e-03	2.170110e-02	3.745036e-03	-3.876034e-02	-4.741478e-02	5.882233e-02	-1.069095e-01
3.112249e-02	7.709707e-02	-6.704995e-02	4.238695e-02	-9.418500e-02	-6.434751e-02	-2.444241e-02	5.776973e-02	-1.976160e-03	1.216823e-02	-5.071141e-02	-5.600825e-02
-7.123835e-02	-8.951021e-03	-3.860366e-02	1.070519e-03	7.829637e-02	-4.814175e-02	9.276747e-02	1.448413e-02	-4.472699e-02	6.549937e-02	1.825712e-02	-1.985794e-02
3.271933e-02	-7.679545e-03	-5.309027e-02	-3.700291e-02	3.474604e-02	2.238809e-02	5.445282e-03	-8.820000e-03	3.246049e-02	8.295700e-02	-7.759536e-03	-1.863241e-02
-9.899961e-02	-6.531850e-03	4.731641e-02	1.793095e-02	2.511272e-02	1.740705e-03	-6.982790e-02	-1.599638e-02	-1.237118e-02	4.218160e-02	-2.152085e-02	-9.388201e-03
-1.747783e-02	-9.384271e-02	-2.365964e-02	6.013965e-02	-7.329135e-03	4.584548e-02	-1.872214e-02	-7.906935e-02	-3.182860e-02	-3.509295e-02	-1.490903e-02	5.633005e-02
5.494574e-02	7.559900e-03	-4.261676e-02	3.361271e-02	3.634698e-03	5.545684e-02	8.660595e-02	-1.890665e-02	-2.068094e-02	6.133835e-02	-4.723006e-03	-6.172762e-03
3.612503e-02	2.632738e-02	3.839540e-03	1.922637e-02	6.119780e-03	5.956573e-02	-2.859851e-02	9.337675e-03	1.066858e-02	-1.023852e-01	1.706653e-02	2.012831e-02
-7.185896e-02	-2.024756e-02	-1.281168e-02	3.411029e-02	2.888985e-02	3.890721e-02	9.970040e-03	4.654614e-02	-3.098518e-02	-1.000798e-02	2.086258e-03	7.157440e-02
1.571435e-02	3.568165e-02	2.366008e-04	-4.248291e-02	-1.312593e-02	6.612428e-02	9.136707e-03	1.036584e-02	-7.098516e-02	-4.345572e-03	1.214915e-01	9.094986e-03
2.959426e-02	-7.274782e-02	-4.241582e-02	5.109688e-02	-1.347847e-02	-1.969832e-02	-1.728416e-02	4.862119e-03	-2.889409e-02	-2.012919e-02	-1.323378e-02	1.407501e-02
4.458323e-02	-2.136544e-02	1.288103e-01	2.522084e-02	1.706086e-02	-8.727577e-02	7.779646e-02	-6.109295e-02	-1.885750e-02	4.865851e-02	-3.538574e-02	4.597635e-02
-2.509869e-03	-1.072410e-02	8.119407e-02	8.559725e-02	-1.617793e-02	-5.445666e-02	-5.051105e-02	4.274982e-04	9.685905e-02	8.709245e-02	8.182213e-02	6.728643e-02
1.438739e-02	-2.233846e-02	-2.605897e-02	2.594756e-02	3.286041e-02	4.594444e-02	-2.321246e-02	-5.704705e-02	-3.016325e-02	-7.248077e-02	-1.353056e-01	-5.320462e-02
-3.195918e-02	-3.965003e-02	4.285590e-02	1.059754e-01	-3.939741e-02	-1.640744e-02	2.433119e-01	6.457496e-02	1.546999e-02	3.157043e-02	-3.454338e-03	1.132732e-01
5.739271e-02	8.422936e-03	-3.838286e-02	5.732361e-02	-5.389544e-02	-6.645302e-03	-8.540145e-02	3.206751e-03	-5.207982e-02	1.186258e-01	-8.646697e-04	8.280651e-02
-2.521329e-04	-4.142531e-02	8.681374e-02	-9.775551e-02	2.498619e-03	-2.139306e-02	8.109511e-02	-7.091404e-02	3.915010e-01	-3.996553e-02	1.985057e-03	-4.003773e-02
-6.280466e-02	-2.209283e-01	5.578937e-02	7.145371e-02	-4.086122e-02	-6.439392e-02	1.130992e-02	3.432087e-02	4.980001e-02	3.328142e-02	5.717958e-02	-1.332640e-02
1.180190e-03	4.199089e-02	-4.340132e-02	-4.537983e-03	-8.873415e-03	2.432784e-02	-3.083320e-01	3.133499e-02	2.633942e-02	2.137781e-02	4.647779e-02	-9.506039e-02
4.793591e-02	-3.920952e-02	-1.147242e-03	1.250534e-03	7.458529e-03	5.401741e-02	-1.674846e-03	1.894429e-02	5.525671e-02	7.109375e-02	1.372296e-02	4.894758e-02
-6.331684e-02	5.312894e-03	-6.614771e-02	-2.866394e-02	5.962365e-02	-1.522241e-02	1.657922e-02	-3.656345e-02	1.162610e-01	-3.441234e-02	1.528947e-02	-1.176724e-01
-2.791927e-02	6.115990e-02	3.803758e-02	-5.213379e-02	1.700226e-02	-2.541423e-02	2.040650e-02	1.312876e-03	6.506786e-02	-6.530667e-03	-2.843723e-02	-3.926858e-03
6.180457e-02	-5.598215e-02	-1.810292e-02	8.989854e-03	-8.630250e-03	-3.243024e-03	6.280518e-02	-8.989531e-02	4.168596e-02	-2.942334e-02	2.947448e-02	-1.739253e-02
-3.778056e-02	1.542021e-02	-1.430069e-03	-7.699469e-03	1.830936e-02	5.124546e-02	6.334582e-03	8.592394e-04	1.901453e-02	-4.213338e-02	1.151159e-02	-4.662337e-02
-3.184187e-02	-1.703876e-02	-3.997327e-02	6.063098e-02	-2.418158e-02	3.319186e-02	3.848450e-03	1.984473e-02	-2.164936e-01	4.501395e-02	1.543440e-02	4.994651e-02
7.067930e-02	-7.402973e-02	4.140399e-02	-4.048699e-02	-3.547501e-02	-1.582017e-02	-4.690566e-03	-2.894699e-03	-6.278580e-02	2.617482e-02	6.944713e-02	8.357466e-02
1.415232e-02	7.870832e-03	-8.519700e-03	-7.050515e-02	1.453790e-02	-9.937067e-02	-1.135923e-02	6.632666e-02	2.923285e-02	-3.901720e-02	4.396728e-03	3.008035e-02

Second MLP Layer Weight (b_2, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-2.808428e-02	-7.007735e-03	3.117389e-02	-3.099765e-02	3.991134e-02	8.091213e-03	4.337511e-03	2.958847e-03	2.385014e-02	1.061317e-03	1.416043e-02	-1.741107e-02

9. Residual Connection

$$\text{input_x3} = \text{input_x2} + \text{h4}$$

(in this case, input_x2 is value before LayerNorm2)

Layer 2

From now on, this is the repeat of layer 1.
However, the input is the result of Layer 1, which is **input_x3**

1. Calculate LayerNorm 1

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \ \widehat{x_i} = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}\ \ (\varepsilon\text{=1e-5})$$

$$\boldsymbol{h_1} = \mathrm{LN}(\boldsymbol{x})_i = \boldsymbol{\gamma_i}\,\widehat{x_i} + \boldsymbol{\beta_i}$$

***** In this case, h1 has shape of (n * 12)

Masked MSA block Weight (γ_i)

1	2	3	4	5	6	7	8	9	10	11	12
1.172357e+00	9.122452e-01	1.039936e+00	1.119288e+00	8.580945e-01	1.116191e+00	9.693699e-01	9.974678e-01	1.044559e+00	1.111009e+00	1.054808e+00	1.060566e+00

Masked MSA block Bias(β_i)

1	2	3	4	5	6	7	8	9	10	11	12
7.259727e-02	-8.546419e-03	-3.731542e-02	3.104292e-01	1.149615e-01	1.175100e-01	-5.597764e-02	1.627964e-01	-4.860411e-03	2.608685e-01	-1.026048e-01	3.019810e-01

2. Calculate Q,K,V, Multihead attention

$$\mathbf{Q} = \boldsymbol{h_1}\mathbf{W_Q} + \boldsymbol{b_Q},\ \mathbf{K} = \boldsymbol{h_1}\mathbf{W_K} + \boldsymbol{b_K},\ \mathbf{V} = \boldsymbol{h_1}\mathbf{W_V} + \boldsymbol{b_V}$$

*Perform a single 12×12 multiplication. (You can also compute by splitting into n*12)

Masked MSA Multihead Attention block *in* Q, K, V weight

Query Weight											
1.624145e-01	-9.438099e-03	8.071346e-02	-3.860031e-02	3.133897e-01	-1.708488e-01	9.024177e-03	1.547996e-01	-2.072956e-01	2.649908e-01	1.835885e-01	4.927286e-02
1.522439e-01	1.334333e-02	1.248620e-01	2.038397e-01	-2.574865e-01	-3.784092e-01	3.612407e-01	-3.897077e-01	4.717741e-01	-7.037898e-02	1.175003e-01	-1.600395e-03
-2.810110e-01	4.755688e-02	1.632130e-01	1.204995e-01	-5.161890e-02	1.898713e-01	-4.105132e-01	-3.674321e-01	3.090789e-01	2.710271e-01	6.405523e-01	-7.350649e-01
-3.291817e-02	-4.992740e-01	-4.781748e-02	3.827656e-01	2.872331e-01	-5.615429e-01	-7.355303e-02	-3.533024e-02	4.101382e-02	-1.950525e-01	2.971037e-01	4.596902e-02
-5.738714e-01	1.906117e-01	-6.178911e-01	1.733912e-01	-5.620744e-01	-1.756225e-01	3.664021e-01	-2.568397e-01	-3.887776e-02	3.587635e-01	5.929713e-02	-1.162686e-01
4.730597e-01	9.556873e-02	-6.691730e-02	2.382826e-01	-6.725737e-01	1.446220e-02	9.553326e-01	2.196742e-01	-1.483462e-01	-3.634938e-01	-7.956273e-01	2.519892e-01
-7.289357e-02	-8.510776e-02	-1.914573e-01	-4.158179e-02	2.455456e-01	-1.118770e-02	-1.440557e-01	6.212415e-01	-8.115252e-01	-2.189289e-01	-1.660463e-01	7.433470e-01
-2.148486e-01	-2.449109e-01	6.285263e-02	1.980509e-01	-3.114553e-01	-3.998583e-01	-1.641098e-01	-1.376100e-01	4.601088e-01	-7.459058e-01	2.415552e-01	1.354724e-01
1.750237e-01	-2.005721e-01	-2.705749e-01	3.336974e-01	-5.552911e-02	-2.487135e-01	1.773397e-01	2.595645e-01	-5.758085e-02	-2.010282e-01	-6.796796e-02	2.519740e-01
-4.805664e-02	-6.027530e-02	8.092668e-02	-2.139272e-01	-9.389076e-03	-3.668600e-01	-1.730429e-01	3.454478e-01	-4.695682e-01	5.591838e-01	1.591225e-01	9.440363e-02
-8.296639e-02	-1.289035e-01	-2.828962e-02	-1.548353e-01	1.110915e-01	1.982315e-01	-1.115429e-01	4.612693e-01	-8.987720e-02	-1.691555e-02	-3.084761e-02	1.896942e-01
-2.049356e-01	1.378499e-01	-2.498730e-01	-3.173443e-01	2.408590e-01	1.681240e-01	-7.310084e-02	-1.136446e-01	-1.723071e-01	4.838990e-02	-1.117007e-01	1.426453e-01
Key Weight											
4.544555e-02	-2.773947e-01	2.261954e-01	-2.281647e-01	5.903457e-01	7.827238e-01	-5.773841e-01	-2.344534e-02	-4.875675e-01	-2.896473e-01	2.931242e-01	-4.826008e-01
2.907512e-01	-4.999436e-01	-1.161166e-01	5.601895e-01	-1.505883e-01	4.079412e-01	2.218659e-01	-1.798275e-01	-2.618463e-02	-6.500468e-01	-2.119785e-01	-9.692355e-02
-2.484820e-01	1.217504e-01	4.961333e-02	-4.069815e-02	-1.908873e-01	3.651659e-01	2.963961e-02	-3.221190e-01	5.433864e-01	-2.467273e-01	1.692747e-01	-2.458006e-01
-2.463119e-01	-2.378412e-01	-9.360334e-02	-5.512526e-02	2.422812e-01	-2.250700e-02	-2.710463e-02	4.013341e-01	1.441922e-01	-5.133580e-01	4.671274e-02	3.900554e-01
6.778052e-01	3.035733e-01	5.906389e-01	3.829136e-01	-2.128232e-01	4.796351e-01	5.373897e-02	-6.438479e-01	-1.147043e-01	-9.842188e-01	-1.752238e-01	-1.963121e-01
4.924527e-01	-7.439625e-01	3.628948e-02	3.314215e-01	3.887130e-01	-1.943265e-01	-9.524753e-03	3.708252e-01	-2.942561e-01	-4.049636e-01	-2.038472e-01	2.623623e-01
1.439334e-01	1.443626e-01	-3.343692e-01	-3.789839e-01	4.084055e-01	3.362020e-01	-2.313766e-01	4.158210e-01	-1.049860e+00	5.963162e-02	-3.206121e-01	2.596034e-01
-6.197649e-03	3.328919e-01	-4.667248e-01	4.832133e-01	-7.959691e-01	-1.403155e-01	7.278005e-01	2.219661e-01	2.709127e-01	-4.567651e-01	-4.171980e-01	4.255459e-01
1.679604e-01	-4.348453e-01	-1.933397e-01	5.044978e-01	-2.299653e-01	-8.862887e-02	2.905832e-01	-2.174807e-02	1.464142e-01	-5.095354e-01	1.001545e-02	4.027172e-02
6.558786e-02	3.533208e-03	-9.301282e-02	-1.437988e-02	2.566876e-03	-4.161351e-02	-2.118174e-01	4.159030e-01	-2.971629e-01	-1.095113e-01	1.102619e-01	-2.322358e-02
3.470794e-01	8.272670e-03	-6.135744e-02	2.397752e-01	1.546178e-01	3.970676e-02	-1.087745e-01	-6.315371e-02	-3.958032e-01	-1.144713e-01	-2.285767e-01	2.057930e-01
-9.225377e-02	-2.848696e-01	3.003165e-02	-1.654892e-01	1.505771e-01	-1.353193e-01	-5.085415e-02	2.283275e-01	-8.436627e-02	1.238024e-01	-4.481592e-02	3.012312e-01
Value Weight											
-3.278750e-01	-1.345084e-01	3.705600e-02	4.868884e-02	2.431773e-01	2.190796e-02	9.552821e-02	-6.722442e-03	7.785143e-02	1.036691e-01	-4.547167e-02	1.422558e-01
3.570159e-01	-2.728993e-04	-2.445555e-01	1.210045e-01	2.218061e-01	-6.616599e-02	4.117461e-02	-1.864199e-01	-4.820843e-02	1.264363e-01	-3.039345e-02	1.183976e-01
2.376896e-01	-6.775007e-02	9.085254e-02	-5.521126e-02	2.103750e-01	-7.513210e-02	-1.155620e-02	-1.932190e-01	-1.658856e-02	2.843453e-03	-2.660478e-02	-2.296168e-01
-6.504632e-02	1.616480e-01	1.033420e-01	-7.904159e-02	-1.553880e-01	-1.701832e-01	-1.179596e-01	2.868271e-01	6.914174e-02	9.968871e-02	2.401392e-01	8.703052e-02
-3.083404e-01	2.179920e-01	-2.030982e-01	-4.401673e-01	1.487084e-01	-4.264757e-01	4.494936e-02	2.060948e-01	1.354002e-01	2.883945e-01	-1.863678e-01	5.590668e-01
3.117070e-01	1.124799e-01	2.193698e-01	-3.422341e-02	-1.517230e-01	-3.296185e-02	2.331339e-01	2.358012e-02	-1.536311e-01	-3.605675e-02	1.759435e-01	-9.406453e-02
-6.695753e-01	-1.950615e-02	-3.345039e-01	-3.123473e-01	-9.762790e-02	-2.329478e-01	-1.406784e-01	5.538306e-01	2.652375e-01	1.892644e-01	-1.722331e-01	5.158924e-01
2.953189e-01	6.561383e-02	1.043632e-01	5.269924e-02	1.899503e-01	2.835465e-01	-1.395685e-02	-1.292054e-02	-1.357009e-01	-1.885305e-01	-8.766425e-02	9.516513e-02
-1.677247e-01	6.818361e-02	2.155989e-01	-2.873662e-01	-1.803548e-02	6.529157e-02	-1.022243e-02	7.492451e-02	-7.419596e-02	6.870912e-02	-1.584983e-01	-1.951259e-02
1.667253e-01	-3.511966e-02	-9.375440e-02	3.248343e-01	-8.082359e-03	1.828896e-01	2.639313e-01	2.868272e-01	-1.389248e-01	-3.747522e-02	-2.694026e-01	2.643350e-02
1.107320e-01	-1.241600e-01	5.468424e-03	1.385256e-01	1.722506e-01	2.299881e-01	2.437823e-02	-8.835125e-02	3.000176e-02	-3.450254e-01	-1.023940e-01	-1.810675e-02
3.258447e-02	1.295040e-01	-1.344221e-01	2.197458e-02	-2.187490e-01	2.427430e-02	8.965177e-02	-5.200688e-02	-3.423892e-02	-9.113051e-02	-1.097563e-01	-1.491315e-01

Masked MSA Multihead Attention block *in* Q, K, V bias

Query Bias											
7.260851e-01	5.990345e-01	3.626682e-01	-2.791425e-01	-2.342048e-01	-6.482888e-02	-2.866837e-01	-7.981344e-01	-7.203748e-02	-1.746933e-01	4.118584e-02	-4.116932e-01
Key Bias											
1.936006e-03	1.055229e-02	-2.981336e-02	1.102254e-01	-1.526059e-02	-5.130705e-02	-1.143592e-01	5.408736e-02	-3.033875e-02	-2.302156e-02	-3.102210e-02	2.874614e-02
Value Bais											
1.034705e-01	1.928400e-01	-1.021686e-01	2.931870e-01	1.250891e-01	1.215772e-01	1.545540e-01	2.522532e-01	-1.264551e-01	1.853869e-01	1.602221e-01	-4.739623e-02

$$\text{QK Score} = \frac{QK^T}{\sqrt{d_k}} \Rightarrow \text{Casual Mask(Upper triangle)} \Rightarrow A = \text{softmax} = \frac{exp(QKScore)}{\sum \text{exp(QKScore)}} \Rightarrow Attention\ Score = A \cdot V$$

*In this case, Multihead(Q,K,V) has shape of (n * 12)

If you calculate with 3 divided heads, you need to concat each heads.

$\mathbf{head_i = A_i V_i,\ i = 1, 2, 3}$ **Multihead(Q,K,V) = Concat(**$head_1, head_2, head_3$)

3. Calculate attn_out score

$$\text{attn_out} = \text{Multihead(Q,K,V)} \cdot \boldsymbol{W_O} + \boldsymbol{b_O}$$

Masked MSA Multihead Attention block *out* weight($\boldsymbol{W_O}$)

1	2	3	4	5	6	7	8	9	10	11	12
7.397891e-02	-6.217564e-02	-4.629865e-02	1.038022e-01	-2.627777e-01	1.342518e-01	-1.545438e-01	-1.617938e-02	-1.110505e-01	4.414389e-02	2.130805e-02	-1.655514e-02
9.095367e-02	-1.248511e-01	2.165619e-01	-8.530050e-02	-2.068749e-01	-2.437384e-02	-2.811618e-01	-3.790256e-02	1.031749e-01	-8.392612e-03	1.457031e-01	-1.648869e-01
-6.294671e-02	-5.728995e-02	1.802934e-01	-3.822100e-01	-2.362082e-01	-7.465045e-02	-3.023837e-01	-2.677619e-02	-1.263888e-01	-1.381983e-01	9.754778e-02	-1.083756e-01
-2.080604e-02	5.614285e-02	1.078515e-02	1.388195e-01	-1.726483e-01	2.322315e-01	-1.117159e-01	1.942724e-01	-1.280641e-01	1.908764e-01	1.786769e-01	1.505349e-01
-3.071793e-01	3.457892e-03	5.993846e-02	1.884029e-01	-2.316388e-02	4.109500e-01	-2.418783e-01	9.037685e-02	9.728067e-02	3.500312e-01	1.238391e-01	8.400109e-02
-1.308550e-01	-8.707072e-02	2.194309e-01	-9.976751e-02	-1.936342e-01	1.726964e-01	-2.909880e-01	-2.573030e-02	1.199559e-01	8.757388e-03	6.352377e-02	-1.568427e-01
7.736985e-02	2.178557e-01	4.032985e-05	4.806525e-02	-9.883817e-02	1.499279e-01	-2.390819e-01	2.691319e-01	-1.768326e-01	1.743374e-01	1.093614e-01	1.466413e-01
2.365263e-01	1.715996e-01	1.526950e-01	-9.954670e-02	-2.141500e-01	-1.139666e-01	-2.696219e-01	1.646579e-01	-1.712021e-01	1.037849e-01	2.391602e-01	-2.362848e-01
-2.055707e-01	4.123328e-03	5.612574e-02	-2.926222e-01	-1.580002e-01	2.558701e-01	-2.452114e-01	9.987704e-02	-6.138575e-02	-4.764600e-02	1.460021e-01	3.190892e-01
-2.793332e-01	-2.095648e-01	1.358126e-01	8.101501e-02	-1.604020e-02	3.546096e-02	-3.889802e-01	-1.447582e-02	-7.468336e-03	2.764913e-01	-1.389737e-01	1.467789e-02
-6.648651e-02	-1.541877e-01	1.141514e-01	-1.250690e-03	-2.083939e-01	1.378028e-01	-2.003497e-01	2.712687e-02	1.839674e-01	1.552211e-01	4.124226e-02	-4.980779e-04
-2.602478e-03	2.990674e-01	2.734167e-01	-6.372160e-02	-5.683573e-02	1.519060e-01	-2.998567e-01	3.575199e-01	-2.588527e-01	2.322959e-01	2.425177e-01	-8.178751e-02

Masked MSA Multihead Attention block *out* bias($\boldsymbol{b_O}$)

1	2	3	4	5	6	7	8	9	10	11	12
-2.452131e-03	-8.009599e-03	-1.399106e-01	-9.819391e-02	1.763125e-02	1.103114e-01	5.715930e-02	4.713771e-03	-2.487050e-01	2.211257e-01	7.350094e-02	2.107744e-01

4. Residual Connection

$$\text{input_x2} = \text{attn_out} + \text{input_x}$$

(in this case, input_x is position embedded matrix)

5. Calculate LayerNorm 2

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \widehat{x_i} = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}\ (\varepsilon\text{=1e-5})$$

$$\boldsymbol{h_1} = \mathrm{LN}(x)_i = \boldsymbol{\gamma_2}\,\widehat{x_i} + \boldsymbol{\beta_2}$$

***** In this case, h1 has shape of (n * 12)

MLP block Layer Norm weight(γ_2)

1	2	3	4	5	6	7	8	9	10	11	12
1.228373e+00	1.182670e+00	1.181346e+00	9.882852e-01	9.761013e-01	1.087607e+00	1.137451e+00	1.103013e+00	8.528818e-01	9.310936e-01	1.172479e+00	9.126095e-01

MLP block Layer Norm bias(β_2)

1	2	3	4	5	6	7	8	9	10	11	12
-4.924535e-01	6.655191e-01	3.126464e-01	-3.493734e-01	-7.790722e-01	6.260208e-01	2.665403e-02	-7.936532e-01	7.441322e-01	5.249609e-01	1.318179e-01	-6.665556e-01

6. Calculate First MLP Layer

$$\boldsymbol{h_3} = \boldsymbol{h_2 W_1} + \boldsymbol{b_1}$$

*In this case, h3 has shape of (n * 48)

First MLP Layer Bias (b_1, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-1.460735e-01	-4.003490e-01	-3.266484e-01	-1.693635e-01	-2.623611e-01	-4.225815e-01	-7.956621e-01	-4.284546e-01	-4.818350e-01	-3.325710e-01	-2.320900e-01	-1.085248e-01
-3.310618e-01	-9.150692e-01	-4.610535e-01	-3.380509e-01	-1.757553e-01	-2.866957e-01	-6.014673e-01	-2.233477e-01	-3.279175e-01	-3.459518e-01	9.577810e-04	-2.375534e-01
-3.913757e-01	-2.336717e-01	-3.112995e-01	-4.421872e-02	-3.109154e-01	-4.172139e-01	-6.220463e-02	-5.799634e-01	-2.389141e-01	-3.557474e-01	-3.218636e-01	-4.493155e-01
-4.451885e-01	-3.293109e-01	-2.015561e-01	-2.340078e-01	-1.630465e-01	-3.977982e-01	-1.256536e-01	2.219219e-01	3.336828e-02	-5.347942e-01	-3.477111e-01	-1.447282e-01

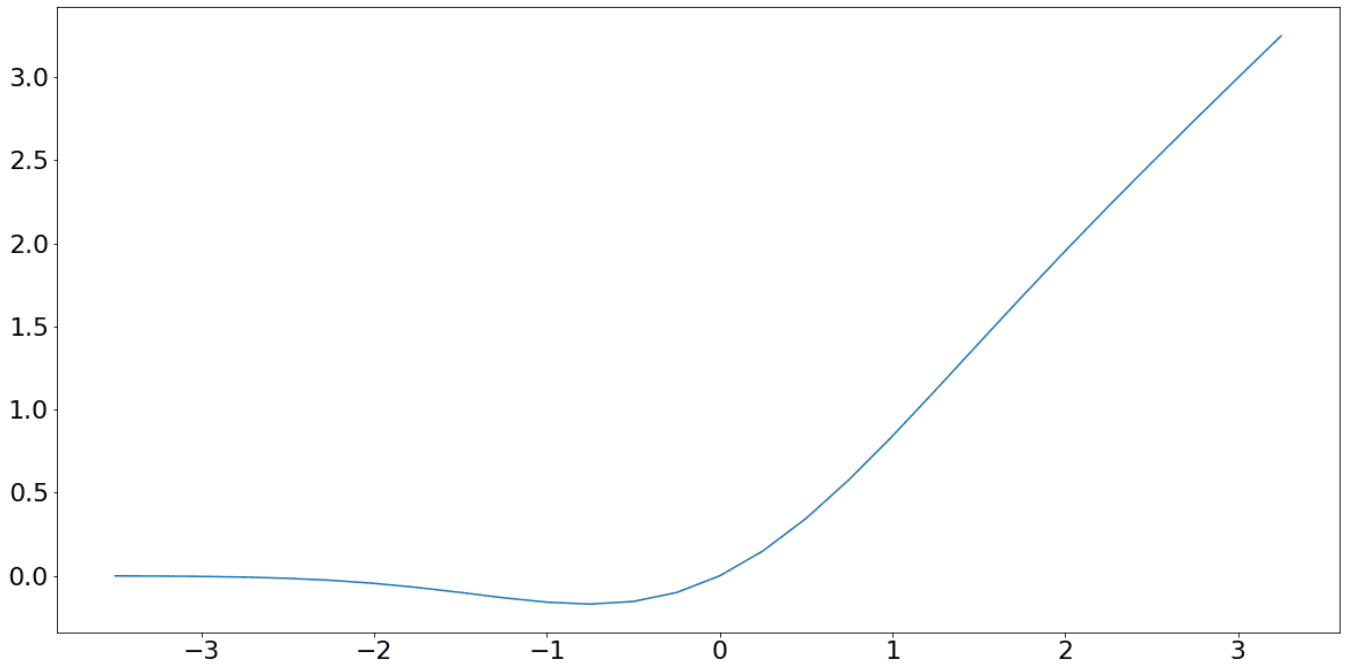
First MLP Layer Weight (W_1, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
6.911775e-02	1.843837e-01	8.591122e-02	-4.056628e-02	-2.676218e-01	-4.883251e-01	-3.219152e-01	1.710352e-01	8.127057e-02	1.082544e-02	2.538148e-01	3.343522e-01
6.062622e-03	-7.184843e-03	4.060288e-03	-1.067601e-01	2.652220e-01	3.561476e-02	-2.020598e-01	2.443257e-02	-2.674464e-01	-1.641853e-02	8.525694e-02	-7.954220e-02
-8.878003e-02	-2.900914e-01	8.194791e-02	5.282148e-02	-1.422569e-01	-4.736072e-01	-1.012733e-01	4.426857e-01	-1.690067e-01	1.872829e-01	1.038096e-01	6.205328e-01
-2.645462e-01	2.407733e-02	-1.000806e-01	3.615150e-02	4.324024e-01	-2.877426e-01	-2.327647e-03	6.465413e-02	2.304419e-01	-1.652264e-01	2.108473e-01	-2.688895e-01
1.724388e-01	-1.079371e-01	-2.500668e-02	1.952271e-01	-5.878562e-05	-1.331380e-01	1.904294e-01	-1.698550e-02	-8.793338e-02	-3.166698e-01	2.367592e-01	2.918372e-02
2.816044e-02	-9.512892e-02	-2.418162e-01	-2.171976e-03	2.417744e-01	-5.658461e-01	1.896327e-01	-7.933733e-02	1.471939e-01	1.045936e-03	4.493658e-02	-7.705207e-03
7.102754e-02	-3.366105e-01	-2.414279e-01	1.244783e-01	5.543936e-01	1.064853e-01	2.841399e-01	4.236528e-01	-3.807603e-01	-3.477368e-01	-1.247706e-01	2.932599e-01
-4.693987e-01	-2.517998e-01	1.195733e-01	-1.885137e-01	3.592320e-01	-2.283584e-01	-2.050130e-01	3.622801e-02	8.538508e-02	-9.303895e-02	4.245929e-01	1.101667e-01
-1.808362e-01	-4.766238e-01	4.303973e-01	-9.471455e-02	1.115912e-01	1.648158e-01	2.697206e-01	-1.037831e-01	-2.807420e-01	-1.594548e-01	5.697530e-02	-2.113059e-01
2.479831e-01	-5.556040e-01	2.739016e-02	5.699001e-02	2.396876e-01	-8.385596e-01	2.256556e-01	2.556401e-01	-2.928690e-01	2.264532e-01	-7.409031e-02	2.026577e-01
-1.480195e-01	1.019552e-01	-1.859834e-01	-2.001313e-01	3.221724e-02	5.888860e-02	-9.259263e-02	-1.167181e-01	1.175357e-01	-3.232361e-01	4.969642e-02	3.188808e-01
-1.168943e-01	-3.858544e-01	1.816737e-01	-1.577002e-01	1.113976e-01	-1.470803e-01	-3.878587e-02	-1.055703e-01	9.292533e-02	-1.363752e-01	3.338148e-01	2.710562e-01
4.092898e-01	2.541498e-01	-1.193482e-01	-2.384429e-01	-1.816814e-01	-1.447409e-01	3.946416e-01	-1.386067e-02	-1.855159e-01	3.299367e-02	7.582243e-02	-7.977816e-02
5.012834e-01	-2.832069e-01	-8.966436e-02	3.731627e-01	2.370299e-01	-2.893164e-01	-1.085483e-01	9.730385e-01	-6.460624e-01	-1.485755e-01	-1.221703e-01	6.205085e-02
1.495447e-01	-2.895350e-02	-7.231198e-02	2.731936e-01	6.474168e-03	5.916114e-02	2.742833e-03	2.272793e-01	4.157181e-02	-4.063222e-01	-2.128650e-01	1.366687e-01
1.941143e-01	-1.914245e-01	-2.148696e-01	3.045203e-01	1.839744e-02	3.379154e-02	2.282492e-02	2.199262e-01	9.527658e-02	-2.969663e-01	5.131260e-02	-1.070706e-02
-4.808914e-02	-1.973774e-01	-2.977222e-01	8.629739e-02	1.919896e-01	-3.006602e-02	8.817330e-03	-1.483953e-01	2.071484e-01	2.423469e-01	-5.499581e-02	-2.050193e-01
-4.742007e-02	-4.716052e-01	2.301870e-01	-5.385605e-01	1.244621e-01	-1.836153e-01	4.321837e-01	4.195324e-03	-1.138270e-01	1.738522e-01	7.468598e-02	1.806767e-01
2.873714e-01	1.076620e-01	-4.980731e-01	-9.473652e-02	-8.658504e-02	2.183601e-01	4.231475e-01	8.050553e-02	-3.908499e-01	-1.117265e-01	-4.702952e-02	2.358804e-01
3.886508e-01	3.022639e-02	-1.371266e-01	5.043661e-02	1.178134e-01	4.285172e-01	2.399983e-01	-1.523992e-01	-1.476015e-01	-3.889247e-02	-3.362105e-01	-1.128013e-01
2.340006e-01	-4.066448e-01	3.782067e-01	1.264189e-01	5.729287e-01	-6.195212e-01	-6.018603e-01	-2.698098e-02	2.000335e-01	-1.798481e-01	2.108676e-01	-2.026688e-02
3.190358e-01	-5.274184e-01	-1.478018e-01	1.459737e-01	2.810901e-01	-1.714696e-01	1.232586e-02	1.090640e+00	-1.834159e-01	-2.287140e-01	-2.398178e-01	1.388507e-01
-1.391845e-01	-3.208580e-02	-9.442683e-02	-2.660229e-01	2.835402e-01	1.107642e-01	3.028451e-01	1.691954e-01	5.491670e-02	-4.932127e-01	1.954819e-01	-1.081313e-01
1.786934e-01	-3.077064e-01	-3.368082e-02	7.203368e-03	-5.529697e-02	-8.896737e-02	-8.129343e-02	-2.653190e-02	-1.178955e-01	-3.014231e-01	7.174466e-01	2.321682e-01
6.765670e-01	-3.503734e-02	-2.926368e-01	1.659088e-01	-2.229387e-02	-4.356470e-02	4.540753e-03	2.212451e-01	-2.932433e-01	-1.103267e-01	-2.749178e-01	5.735178e-01
-1.515214e-02	1.264513e-01	-1.976111e-01	2.391709e-01	-8.162221e-02	-1.062197e-01	-7.583345e-02	-5.099814e-03	2.731159e-02	1.149239e-01	9.936719e-02	-1.939027e-02
-1.780776e-01	8.021633e-02	-1.206801e-01	-2.709275e-01	-1.132045e-01	-4.004577e-01	1.189896e-01	2.311017e-01	2.042031e-01	4.133911e-01	-1.774705e-01	3.681663e-02
-2.686013e-01	-5.924163e-01	3.461178e-02	8.954684e-02	-6.160764e-03	1.429614e-01	-2.827331e-01	1.825264e-01	1.196436e-01	2.562626e-01	-1.174548e-01	3.738781e-02
8.339261e-02	-4.238895e-01	2.806526e-01	2.901022e-01	2.077127e-01	3.852810e-01	-3.175797e-01	-1.851386e-01	-3.801116e-01	5.252100e-02	-3.164604e-01	1.310185e-01
1.322366e-01	-1.653986e-01	5.399252e-01	-2.671957e-01	5.959595e-01	-3.842081e-01	1.258449e-02	1.192976e-01	-3.706736e-02	-1.248360e-01	-2.138305e-02	-3.947032e-01
1.348458e-01	-1.021357e-01	-1.800024e-01	1.061740e-01	1.935453e-01	-9.460095e-02	-4.808237e-02	-4.365038e-01	8.100404e-02	6.850351e-02	2.287480e-01	1.664430e-01
6.613149e-02	1.050985e-01	-6.272864e-02	-1.472739e-01	2.650899e-01	-8.385604e-02	-2.169645e-01	1.512930e-01	-3.033875e-01	6.577106e-02	7.749699e-02	2.392772e-02
5.554162e-01	6.220041e-02	4.465340e-01	-1.756833e-01	5.782017e-03	-3.156301e-01	-1.772954e-01	-2.190545e-01	-2.328668e-01	-3.610477e-01	3.442444e-01	5.259137e-01
2.871677e-02	3.535694e-01	1.986066e-01	1.912476e-01	2.173560e-02	-1.002797e-01	-3.292443e-02	-2.266429e-01	-3.085351e-01	1.434321e-01	-5.141833e-01	1.229946e-01
-1.087980e-01	1.663366e-01	5.066839e-01	-2.078192e-01	-1.249738e-01	-2.838343e-01	1.318664e-01	1.527453e-01	-2.207895e-01	-5.508792e-02	-1.388687e-01	3.741400e-02
1.062036e-02	-3.453961e-02	1.010512e-01	-2.747152e-01	9.010043e-02	8.310009e-02	-2.168696e-01	1.510475e-01	-2.023785e-01	1.600615e-02	-9.955123e-03	-2.132519e-02
3.305688e-01	-1.354156e-01	1.761997e-01	-1.364726e-01	4.407424e-01	-7.588930e-03	-2.605478e-01	2.884372e-01	-3.489092e-01	-1.546427e-01	7.649530e-02	3.168139e-01
-1.495923e-01	-4.043329e-01	1.748380e-01	1.461780e-01	6.092191e-01	-3.558883e-01	1.012171e-01	-4.775739e-02	1.526335e-02	-3.369631e-01	1.216353e-01	7.361339e-02
-3.966698e-01	-2.054695e-02	4.353288e-01	-8.773441e-03	3.825736e-01	7.182840e-02	-9.565526e-02	4.901680e-02	1.815300e-02	-3.517292e-01	-1.114326e-01	1.446739e-01
6.998955e-02	-3.631848e-01	-1.044226e-01	1.310712e-01	3.004791e-01	-2.485364e-02	-2.674485e-02	6.772159e-01	-2.413749e-02	-5.387827e-01	-1.135544e-01	-4.158718e-02
2.091623e-01	-5.928998e-02	1.332631e-01	-5.604968e-02	-1.563626e-02	-8.857167e-02	1.272855e-01	-6.438626e-02	6.382309e-04	-2.050525e-02	1.056910e-01	-9.010646e-02
2.194384e-01	3.855797e-01	-5.539037e-02	5.047749e-01	2.726832e-01	-5.964614e-01	-5.291317e-01	8.473531e-02	6.025128e-02	-9.271245e-03	-3.670653e-02	-3.047142e-01
-9.512211e-02	-3.126647e-01	-7.687338e-02	-4.590636e-02	-2.723436e-01	1.882223e-01	1.145077e-01	2.445154e-01	-1.197581e-01	-5.372212e-02	4.477701e-01	2.225369e-02
1.939057e-01	1.624009e-01	-1.162887e-01	1.575252e-01	3.895137e-02	1.161256e-01	-2.118452e-01	1.121270e-01	-2.495289e-02	-2.401346e-01	3.577313e-02	8.057560e-02
-5.385280e-02	-1.798985e-01	-3.772156e-01	4.015246e-02	2.910159e-01	4.841631e-02	-2.331502e-01	1.067937e-01	7.221774e-02	-2.581961e-01	-2.056146e-02	4.517883e-01
-3.872576e-03	-2.266365e-01	-5.399941e-02	1.140557e-01	-1.085780e-01	-2.070497e-01	1.120036e-01	-4.179348e-02	1.956143e-01	-2.952590e-02	1.413199e-01	-2.506842e-02
3.835225e-01	-5.712838e-01	-3.774336e-01	6.423384e-01	1.337960e-01	2.204406e-01	-2.202918e-02	1.057689e-01	-2.954580e-01	-1.962430e-01	2.054457e-01	-1.690480e-01
-7.516514e-02	3.984958e-02	-1.596664e-01	1.892912e-01	1.026179e-01	-1.985448e-01	3.327379e-01	-3.099835e-01	-2.057117e-01	9.003332e-02	4.491915e-01	2.308423e-02

7. GELU Activation Function

$$\boldsymbol{h_3 = GELU(h_3)}$$

*In this case, h3 has shape of (n * 48)



8. Calculate Second MLP Layer

$$\boldsymbol{h_4} = \boldsymbol{h_3 W_2} + \boldsymbol{b_2}$$

Second MLP Layer Weight (W_2, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
1.203009e-02	8.711203e-03	-4.908540e-02	3.788391e-02	-2.777771e-02	9.075329e-02	-1.264138e-01	2.280317e-02	-4.429399e-02	1.378133e-02	8.544517e-02	3.009379e-02
-2.293634e-02	2.742513e-01	-3.029029e-02	-1.896934e-02	6.157659e-02	-3.491247e-02	5.603504e-02	-5.571539e-02	1.025958e-02	-2.214243e-02	-5.074319e-02	-1.029453e-01
1.964789e-02	6.731129e-02	7.088151e-02	2.427800e-02	3.889890e-02	-4.050056e-03	4.139636e-02	1.183085e-02	-8.113328e-02	-7.082480e-02	-6.543521e-04	6.177840e-02
5.418724e-02	3.508852e-02	1.918876e-02	-7.630088e-02	-8.930616e-02	-4.065796e-02	2.784786e-03	-9.072121e-04	1.890805e-02	5.126539e-02	8.117689e-03	1.710665e-02
-4.508667e-03	-3.650137e-02	1.836753e-02	-2.544714e-02	-6.276906e-02	4.648552e-02	-3.120883e-02	4.323812e-02	-2.754857e-03	-3.912506e-02	2.756311e-02	6.585758e-02
-6.317411e-02	2.114956e-01	4.690688e-03	2.811406e-02	6.232024e-02	-1.746013e-02	2.676605e-02	-3.868850e-02	1.599793e-01	5.583537e-03	-5.247173e-02	-8.598469e-02
-3.978328e-02	-1.209138e-01	2.533970e-02	5.494362e-02	-5.748544e-03	3.972846e-02	3.546355e-02	2.272408e-03	-4.953817e-02	-8.480011e-03	3.209021e-02	-3.677373e-02
-6.554723e-02	-1.474854e-01	7.411908e-02	-9.034722e-02	-2.688486e-02	2.738139e-03	-5.903943e-02	-2.993549e-02	-1.122630e-02	2.217251e-02	-1.024425e-03	2.503700e-02
2.511182e-02	-4.589464e-02	1.670061e-03	1.088676e-01	-8.048607e-02	1.762518e-02	7.843176e-02	3.756904e-02	6.403409e-03	-1.601276e-01	1.578257e-01	2.481684e-02
9.448264e-02	3.149436e-01	-3.256433e-02	4.048313e-03	1.222148e-01	2.707105e-03	-4.291253e-02	3.804821e-02	-8.654760e-02	6.754476e-02	3.606501e-02	1.747528e-02
-5.038130e-02	1.391966e-01	6.777822e-02	2.103239e-02	-1.188749e-02	-6.440823e-03	1.391542e-01	-3.671828e-02	4.017859e-02	1.423988e-01	-9.963267e-02	-5.440525e-02
2.218749e-02	-6.719983e-02	2.714911e-02	9.111822e-02	-9.418263e-03	9.494998e-02	-2.723619e-02	1.142559e-02	-2.211182e-02	-1.883870e-02	-1.446471e-02	1.091197e-01
-8.716792e-02	6.580375e-02	4.484093e-02	-2.759805e-02	-4.656988e-02	1.030495e-01	-3.243396e-01	-3.604169e-02	-3.135937e-02	1.490002e-01	1.496743e-03	9.515096e-03
-1.233888e-01	-8.129000e-02	-1.150198e-01	-8.481218e-02	-7.794497e-02	-4.415477e-02	8.650485e-02	-5.332040e-02	3.653499e-02	1.105928e-01	2.406982e-02	-1.113626e-01
4.105748e-02	-8.594457e-02	-1.270222e-02	-4.819016e-02	-1.238062e-02	-7.472146e-02	-3.698082e-02	9.688221e-02	-7.366606e-02	4.274289e-03	4.718580e-02	5.758873e-02
8.605767e-02	4.070453e-02	1.488722e-02	4.319933e-03	4.879565e-02	-1.867243e-02	4.242617e-03	3.620454e-02	5.747314e-02	7.511279e-02	-9.829653e-02	-1.003331e-01
1.374577e-02	3.441375e-02	4.697135e-04	-7.233359e-02	1.499947e-02	-2.645178e-02	-2.461716e-01	4.000528e-02	-4.130180e-02	5.837404e-02	-4.941732e-02	-7.805152e-03
6.502528e-02	-1.876532e-01	1.036637e-01	8.368732e-02	-1.237500e-01	5.712693e-02	-3.443987e-02	-1.928356e-02	-1.059284e-01	1.206369e-01	-5.645555e-02	-1.554050e-02
-4.379853e-03	-3.201143e-02	4.281104e-02	-2.658923e-02	-1.137526e-02	2.405100e-02	-6.269916e-02	-7.850745e-02	-7.178057e-03	7.862454e-03	2.817306e-02	6.798995e-02
-3.901285e-02	1.625706e-02	-7.504817e-02	1.554302e-01	-1.907808e-03	9.949576e-04	5.411354e-02	-5.654742e-03	-2.748012e-02	4.471076e-02	1.861120e-01	-1.774321e-01
5.335834e-02	-7.041389e-02	-6.797093e-02	4.127354e-02	-6.168522e-02	-3.025672e-03	8.754379e-02	-1.015148e-02	9.639790e-03	-1.477885e-01	-2.753987e-02	-5.906272e-03
-5.528888e-02	5.650583e-02	5.162130e-02	2.474027e-02	-2.853787e-02	6.974214e-02	-5.704793e-02	2.872057e-02	3.730102e-02	1.260917e-01	-3.024733e-02	-2.712753e-02
-3.380751e-02	6.124196e-02	9.023251e-02	6.269438e-02	7.848097e-02	1.419435e-01	-1.637977e-02	-8.968484e-02	-1.896361e-02	7.130758e-02	1.145027e-01	-7.982509e-02
-1.560777e-01	-1.104099e-01	3.211924e-03	1.403275e-01	-3.962782e-02	4.163025e-02	-1.588148e-02	5.020566e-02	1.067797e-02	-5.854756e-02	-4.064786e-02	-2.429811e-02
1.525321e-02	3.060989e-02	3.838035e-02	-7.129011e-02	-3.673587e-02	4.097010e-02	-7.089333e-02	-2.403882e-02	-3.306573e-02	1.312525e-01	-6.232062e-05	6.189564e-02
-1.853942e-02	-1.488450e-01	-6.669381e-02	-8.098210e-02	-6.374207e-02	-4.605162e-02	5.931106e-02	-6.857958e-02	9.764548e-02	9.561365e-02	-6.071608e-02	-6.272243e-03
-3.456000e-03	3.591146e-02	-3.251653e-02	1.672023e-02	-7.489149e-03	-1.177189e-01	-3.699128e-02	6.937984e-02	3.489500e-02	-4.269299e-02	-7.598850e-02	2.710705e-02
2.517114e-02	4.949595e-02	-6.355862e-02	-9.025263e-03	7.606383e-04	2.234613e-02	2.471935e-02	-2.377089e-02	4.450289e-03	6.557740e-02	-1.272182e-01	-5.162885e-02
-2.644886e-02	2.975726e-02	4.902284e-02	-2.249357e-02	4.282946e-02	6.175473e-02	-3.253509e-02	2.419047e-02	-4.768481e-02	1.217370e-02	5.819328e-02	3.967244e-02
1.480749e-02	2.230016e-01	1.283482e-02	2.852399e-02	2.739893e-02	7.943054e-02	-3.627796e-02	3.757189e-02	4.526583e-02	-4.684272e-02	3.833983e-02	6.400721e-03
5.078221e-02	8.686792e-03	3.183815e-02	-4.756654e-02	-3.012258e-02	1.537382e-02	5.016672e-02	2.600693e-02	-5.709336e-03	5.274877e-02	-9.278062e-02	4.253828e-02
-8.431355e-03	-8.102131e-03	-2.010091e-03	1.197067e-02	-1.713173e-02	6.346150e-03	4.124056e-02	1.779575e-02	-1.718605e-02	1.851398e-02	-1.012589e-01	-6.268752e-03
2.477618e-02	-4.979134e-02	1.980375e-02	6.178940e-02	-9.734300e-02	-7.818473e-03	2.452493e-01	-4.266696e-02	1.050905e-01	-6.846540e-05	-1.233276e-02	8.529090e-02
8.848231e-02	-1.529587e-01	-8.561627e-02	-1.376968e-01	6.355746e-02	-1.264677e-02	2.040046e-02	6.998052e-02	-1.406075e-01	1.070029e-01	-4.059391e-03	1.083923e-02
-1.376874e-02	1.074604e-01	2.841028e-02	1.411755e-02	7.303095e-03	-5.688302e-02	2.631511e-02	1.093917e-01	1.302875e-02	1.844951e-02	2.692457e-02	-9.961666e-02
1.000284e-01	1.035063e-01	8.147851e-03	-1.829459e-02	8.076475e-02	7.106320e-02	4.346574e-02	4.316854e-02	6.280061e-02	9.448913e-03	3.389051e-02	4.815015e-02
6.209474e-02	-8.705387e-02	8.630420e-02	-4.122757e-02	1.247126e-03	-1.685515e-02	-3.439866e-01	6.135345e-02	5.447454e-02	-3.713467e-02	7.053195e-02	2.021516e-02
2.461625e-02	2.138194e-01	6.097676e-02	4.594697e-02	5.813807e-02	-5.968021e-02	1.495886e-02	1.116322e-02	1.524795e-02	-1.836950e-02	5.331650e-02	-3.319474e-02
-4.868073e-02	-7.966968e-02	-1.227750e-02	6.544768e-02	2.617106e-02	6.489465e-02	-9.086533e-02	-1.083310e-01	4.721278e-02	-7.473481e-02	-1.932366e-02	-1.797787e-03
-7.497769e-02	-1.068491e-01	5.285514e-02	-2.774955e-02	-3.759483e-02	3.796098e-02	8.009918e-02	-4.213737e-02	-4.613210e-02	-1.600582e-03	8.029904e-02	-1.026428e-01
-9.838394e-02	5.986496e-03	-3.717999e-02	-5.492974e-02	-3.471651e-02	-1.363913e-02	-2.066695e-01	5.663643e-02	-1.327350e-02	-1.991537e-02	5.212422e-03	1.341130e-03
-2.759451e-02	9.817190e-03	6.101592e-02	3.965614e-02	9.503770e-03	-7.611816e-02	-1.260445e-03	-1.898231e-02	5.018329e-02	1.140667e-01	2.687895e-02	-1.307656e-02
-6.896446e-02	-9.038033e-02	2.551706e-02	-8.055238e-02	-4.226598e-02	-9.167382e-03	-8.424299e-03	-4.962463e-02	9.816603e-03	1.791038e-02	3.041770e-02	-1.383809e-03
3.433970e-02	-1.018433e-01	4.894012e-02	1.022584e-03	-5.584127e-02	1.698894e-03	4.752786e-02	-4.382009e-02	-5.992562e-04	-7.439802e-03	1.565364e-01	-5.521530e-02
-3.229127e-02	5.435386e-02	1.396288e-01	-1.856896e-02	4.899584e-02	8.634371e-02	-1.184036e-01	-2.847103e-02	2.588561e-03	1.806365e-01	-8.906235e-02	-3.326091e-02
1.012223e-02	-3.171287e-01	2.814401e-02	1.969164e-02	-4.775022e-02	1.569173e-02	-7.606544e-02	-7.220425e-02	-1.321761e-01	-4.817657e-02	-9.110251e-03	-1.042227e-02
-3.480501e-02	-5.259216e-02	-6.573295e-02	-5.069616e-02	1.146034e-01	-2.189316e-02	5.917747e-03	4.956196e-02	-3.754982e-02	-1.033714e-01	-6.220735e-03	6.946164e-02
-2.394829e-02	3.017544e-02	-1.008746e-01	1.019611e-01	5.746375e-02	3.634664e-02	-1.631798e-02	4.694669e-03	-8.056104e-03	2.806857e-02	-1.854857e-01	-4.300339e-02

Second MLP Layer Bias (b_2,MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-3.948552e-03	-1.351664e-02	3.315831e-02	-3.731062e-02	-8.695372e-03	2.785660e-02	-1.368493e-02	3.790501e-02	3.755065e-02	1.493644e-02	-2.286415e-02	-2.535901e-02

9. Residual Connection

$$\text{input_x3} = \text{input_x2} + \text{h4}$$

(in this case, input_x2 is value before LayerNorm2)

Layer 3

From now on, this is the repeat of layer 2.
However, the input is the result of Layer 2, which is **input_x3**

1. Calculate LayerNorm 1

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \ \widehat{x_i} = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}\ \ (\varepsilon\text{=1e-5})$$

$$\boldsymbol{h_1} = \mathrm{LN}(\boldsymbol{x})_i = \boldsymbol{\gamma}_i\,\widehat{x_i} + \boldsymbol{\beta}_i$$

***** In this case, h1 has shape of (n * 12)

Masked MSA block Weight

1	2	3	4	5	6	7	8	9	10	11	12
1.729583e+00	1.795386e+00	1.594847e+00	1.742226e+00	1.789152e+00	1.541283e+00	1.858812e+00	1.845405e+00	1.967943e+00	1.561118e+00	1.865987e+00	1.729683e+00

Masked MSA block Bias

1	2	3	4	5	6	7	8	9	10	11	12
-2.402721e-02	-3.884875e-02	4.040448e-03	-5.860642e-02	3.511279e-02	3.299000e-02	-1.001769e-01	1.462631e-02	-4.662107e-02	2.345084e-01	-4.572881e-02	-1.225817e-01

2. Calculate Q,K,V, Multihead attention

$$\mathbf{Q} = \boldsymbol{h_1}\mathbf{W_Q} + \boldsymbol{b_Q},\ \mathbf{K} = \boldsymbol{h_1}\mathbf{W_K} + \boldsymbol{b_K},\ \mathbf{V} = \boldsymbol{h_1}\mathbf{W_V} + \boldsymbol{b_V}$$

*Perform a single 12×12 multiplication. (You can also compute by splitting into n*12)

Masked MSA Multihead Attention block *in* Q, K, V weight

Query Weight											
-8.074458e-02	-1.527655e-01	-8.220527e-02	5.589002e-02	1.217387e-01	1.841144e-01	4.616685e-02	-2.112111e-01	2.789603e-01	-2.202297e-01	-9.401225e-02	-5.091482e-02
-3.406392e-02	1.317771e-01	1.605297e-01	6.814778e-03	-1.505139e-01	-1.487920e-01	-4.067770e-02	-1.216573e-01	3.260824e-01	3.983261e-04	7.093691e-02	-1.921406e-01
2.946655e-03	1.500054e-01	-2.162834e-03	2.430795e-02	-3.580060e-01	-2.364348e-01	3.602637e-01	6.378414e-02	5.695076e-02	-2.225916e-01	-2.215335e-01	1.003324e-01
-1.078874e-01	5.526710e-02	9.016913e-02	-2.149014e-01	-9.380607e-02	1.851926e-01	1.153719e-01	5.780471e-02	3.547637e-02	3.208186e-02	-3.284916e-01	1.170587e-01
-3.059078e-01	-2.470222e-01	5.089273e-01	-1.763547e-01	7.509974e-01	3.828113e-02	-2.683822e-01	-1.438510e-01	3.482106e-01	-3.117459e-02	5.029828e-02	-3.605950e-01
4.182880e-01	-3.077720e-01	-5.455999e-01	7.188264e-01	4.506584e-02	-3.667283e-01	9.309708e-01	5.357420e-01	-2.101556e-01	-6.578912e-01	-7.382463e-01	1.502163e-01
-3.495197e-03	-2.286678e-01	-4.166804e-01	-6.653655e-01	1.065230e+00	3.671809e-01	-5.876834e-01	8.520470e-01	-1.498710e+00	4.793041e-01	-3.916142e-02	4.936333e-01
-2.458334e-01	5.080886e-01	-1.496832e-01	-4.483705e-01	4.455538e-02	6.380055e-01	-1.924866e-01	-5.562857e-01	-1.509962e-01	8.447312e-01	2.176599e-01	-8.805032e-01
5.885034e-01	-4.317944e-01	-6.390578e-01	6.405872e-01	4.155094e-02	-6.358574e-01	6.433270e-01	1.016803e+00	-7.589518e-01	-8.521565e-01	-7.980556e-01	9.687834e-01
-6.200528e-01	4.944947e-01	-3.213366e-01	-1.091953e-01	8.187163e-03	3.536356e-01	-3.248939e-01	1.816190e-01	-5.321940e-01	5.852949e-01	2.378217e-01	-7.417203e-02
-4.869077e-02	6.433913e-01	1.469366e-01	5.444482e-01	-1.219432e+00	-2.574964e-01	8.469025e-01	-7.675541e-01	9.161193e-01	-4.632445e-01	-4.134924e-01	-3.742158e-01
2.928643e-01	4.163838e-01	-8.259466e-02	-6.443046e-01	3.645095e-01	4.529645e-01	-1.219549e-01	-7.464389e-02	-6.860425e-01	5.786003e-01	-5.810809e-02	-2.495915e-01
Key Weight											
-4.807751e-02	-9.242162e-02	1.044871e-02	1.075848e-01	-7.684973e-02	-1.902946e-01	2.418898e-01	9.342862e-02	-1.161533e-01	1.958524e-02	4.939143e-01	1.211831e-01
1.990402e-02	-2.564647e-02	-1.538424e-01	3.809120e-01	-6.588577e-02	1.251219e-01	2.634732e-02	-1.444424e-01	3.680587e-01	-3.135453e-01	-1.155311e-02	-2.097385e-01
1.374506e-01	-2.229414e-01	-7.793665e-02	1.788276e-01	1.344101e-01	-1.453692e-01	1.490691e-01	-1.195817e-01	1.280316e-01	-2.821225e-02	-3.782430e-01	2.283264e-01
-4.448960e-01	-5.859257e-02	-2.273784e-01	3.729085e-01	-1.832025e-02	5.651188e-01	-1.512707e-03	9.471650e-02	-2.577764e-01	-2.012200e-01	-2.964363e-02	-2.681492e-01
-4.258876e-01	2.764931e-01	-6.994933e-02	-2.156398e-02	-6.322830e-01	9.972442e-03	-2.622843e-01	-2.231533e-01	2.155574e-01	1.340795e-01	5.359516e-01	2.616929e-01
4.473931e-01	-5.291346e-01	-3.622194e-02	2.681993e-01	3.048320e-01	-8.299708e-01	1.295634e-01	1.721012e-01	-3.141952e-01	-4.191516e-02	-1.043809e-01	7.284256e-01
-4.681243e-02	1.870855e-01	-4.333910e-01	-6.689891e-01	8.100865e-01	4.051008e-01	-5.886695e-01	3.973047e-01	-1.141619e+00	8.084608e-01	2.328863e-01	1.312033e-01
2.508210e-02	1.743076e-01	9.892637e-01	-7.359470e-01	-5.310953e-02	1.418205e-01	-5.334195e-01	-9.163553e-01	3.952149e-01	8.476889e-01	3.972943e-01	-8.342105e-01
4.321763e-01	-5.769811e-01	-4.731823e-01	2.153552e-01	7.400428e-01	-4.896563e-01	1.721208e-01	6.726421e-01	-8.226047e-01	-1.858043e-01	-3.708670e-01	7.428961e-01
5.301908e-01	1.922117e-01	3.689007e-01	-9.138889e-01	2.781148e-01	4.057328e-01	-1.860706e-01	-2.542258e-01	-3.692662e-01	3.740178e-01	-3.068868e-01	-2.228114e-01
2.995879e-01	-5.046754e-01	5.964574e-01	4.075981e-01	-3.337122e-01	-5.164583e-01	4.429687e-01	-3.738835e-01	7.948289e-01	-5.705644e-01	-3.960900e-01	-2.135627e-01
-1.865200e-01	-2.246085e-01	4.699824e-01	-4.913161e-01	7.748985e-01	2.419919e-01	-6.584081e-01	-1.452826e-01	-3.141019e-01	9.948271e-01	4.093822e-01	-6.203460e-01
Value Weight											
3.114341e-01	-1.742191e-01	-2.450296e-01	-1.135639e-02	-8.634908e-02	-8.478434e-02	2.849338e-01	-2.419736e-01	-5.619132e-02	-8.090781e-02	3.096182e-01	6.779769e-02
5.539706e-01	4.802223e-01	9.320119e-03	-2.483850e-01	-7.114676e-03	-2.427709e-01	-1.131786e-01	-3.979350e-01	2.340028e-01	2.883392e-01	-3.178863e-01	2.984040e-03
-2.293994e-01	-4.103361e-01	-1.461912e-01	-1.067840e-01	2.749963e-01	6.546049e-03	3.341171e-01	9.759494e-02	-2.874720e-02	2.307698e-01	4.710787e-02	-3.344728e-01
-4.819911e-02	-4.583348e-01	1.820955e-01	-1.100346e-01	1.864210e-01	4.719472e-02	6.806206e-02	-1.071141e-01	1.807569e-01	-2.485354e-01	-1.211310e-01	4.164360e-01
1.247744e-01	1.631722e-01	-2.871226e-01	3.044999e-01	-2.291562e-01	2.106858e-01	-5.245624e-01	-2.967300e-01	1.125463e-01	5.223181e-01	-7.247754e-01	3.767092e-01
5.733922e-01	-1.313932e-01	9.045974e-01	5.131675e-03	1.677125e-01	-3.249928e-01	1.041192e-02	-4.443370e-01	-2.506574e-01	4.979029e-02	1.346475e-01	2.421432e-01
-4.062411e-01	-3.278851e-01	1.520162e-01	3.558004e-02	-4.698613e-01	-3.034643e-02	4.257220e-01	2.238287e-01	-2.067605e-01	6.405828e-01	2.050410e-03	-1.746734e-01
2.774968e-01	-2.587448e-01	-3.567062e-01	-2.790404e-01	-5.591266e-01	1.946327e-01	-1.948346e-01	1.794376e-01	1.595736e-01	-3.497660e-03	6.828648e-01	5.548087e-01
7.867305e-01	-3.563537e-02	-2.478265e-01	-6.484011e-01	-2.252886e-01	-1.919284e-01	4.720704e-01	-2.061963e-01	1.403017e-03	4.032412e-01	-4.363633e-01	-1.760170e-01
-2.935042e-01	-1.229727e-01	-2.880693e-01	3.921317e-01	1.449002e-01	8.263685e-01	1.936697e-01	1.446422e-01	-6.482433e-02	-1.206179e-01	-3.588179e-01	-4.795861e-01
-3.614096e-01	8.231920e-01	-1.094603e-01	-2.341235e-01	5.385849e-02	-3.524358e-01	4.338840e-01	-2.225449e-01	-2.292364e-01	-3.862143e-01	-2.813339e-02	1.027331e-01
-5.193973e-02	-2.290022e-01	9.899805e-02	7.257112e-01	-3.139459e-01	1.055938e+00	3.561758e-01	-8.262034e-01	-8.003629e-01	-4.277416e-01	7.514923e-01	3.818447e-01

Masked MSA Multihead Attention block *in* Q, K, V bias

Query Bias											
-1.616572e-01	5.113970e-01	-1.669877e-01	6.334691e-01	2.551297e-01	1.062378e-01	3.860405e-02	2.784129e-01	-2.410935e-01	3.093576e-02	-7.223374e-02	4.195296e-01
Key Bias											
2.322809e-02	-1.933946e-02	6.813013e-02	-2.431024e-02	3.568509e-02	-3.839408e-02	-2.507732e-02	4.931458e-03	2.612824e-02	-1.331860e-01	4.638669e-02	4.842025e-02
Value Bias											
-8.873230e-03	3.915556e-01	6.868466e-02	2.088941e-02	-5.364917e-02	1.168198e-01	2.448291e-01	-9.719197e-02	-9.092647e-02	1.567062e-02	-3.010655e-01	-1.500557e-01

$$\text{QK Score} = \frac{QK^T}{\sqrt{d_k}} \Rightarrow \text{Casual Mask(Upper triangle)} \Rightarrow A = \text{softmax} = \frac{exp(QKScore)}{\sum \text{exp(QKScore)}} \Rightarrow Attention\ Score = A \cdot V$$

*In this case, Multihead(Q,K,V) has shape of (n * 12)

If you calculate with 3 divided heads, you need to concat each heads.

$\mathbf{head_i = A_i V_i,\ i = 1, 2, 3}$ **Multihead(Q,K,V) = Concat(**$head_1, head_2, head_3$)

3. Calculate attn_out score

$$\text{attn_out} = \text{Multihead(Q,K,V)} \cdot \boldsymbol{W_O} + \boldsymbol{b_O}$$

Masked MSA Multihead Attention block *out* weight($\boldsymbol{W_O}$)

1	2	3	4	5	6	7	8	9	10	11	12
-1.611875e-01	-3.071199e-01	-1.622088e-02	-1.651277e-01	-8.474842e-01	-9.346099e-02	3.804362e-01	-4.491232e-01	-9.215099e-01	8.857260e-01	-3.522520e-01	3.764018e-01
4.134541e-02	-5.057361e-02	1.802931e-01	-2.466024e-02	-4.573048e-01	5.902157e-01	5.819846e-01	-9.293579e-01	-1.457399e-01	4.376119e-01	6.421663e-01	7.178560e-01
-2.831455e-01	2.576225e-01	-2.405562e-01	4.739849e-02	3.510373e-01	1.411525e-01	5.646434e-01	-5.993954e-01	-5.679304e-01	6.943768e-01	-3.429343e-01	5.711059e-01
2.500055e-01	-7.337531e-02	-6.342332e-01	8.519331e-03	-5.954629e-01	3.146345e-01	6.286336e-03	2.821246e-01	-3.799563e-01	-1.948895e-01	-8.175103e-02	6.717931e-01
2.861499e-01	-2.360647e-01	3.471978e-02	-3.277047e-01	-7.467467e-01	4.547829e-01	5.832056e-01	5.570202e-01	-2.193117e-01	-6.276113e-01	7.358955e-01	1.007252e+00
-1.823688e-01	6.908903e-01	-1.303232e-01	-6.909944e-02	-3.092594e-01	4.979165e-01	3.877749e-01	2.316125e-01	8.035210e-01	1.843919e-01	-6.346939e-01	8.569674e-01
-2.578601e-01	-3.112593e-01	-3.661416e-01	4.063176e-01	-1.004821e-01	1.104697e+00	-6.405898e-01	9.387131e-02	-5.203148e-01	-4.513304e-01	-6.440834e-01	7.065216e-01
-1.216377e-02	-1.733538e-01	-3.441106e-01	-1.639469e-01	1.121325e+00	4.163636e-01	8.072104e-03	-1.641892e-01	-1.572695e-01	4.765351e-01	-1.544358e-01	8.756303e-01
3.735008e-01	4.142904e-01	-3.543835e-01	2.544990e-01	2.223329e-01	-7.981083e-02	-5.780609e-02	-5.498382e-01	-2.003158e-02	8.754022e-02	1.093511e+00	5.865785e-01
-4.198554e-01	5.411144e-01	-4.779346e-01	-2.998451e-01	-2.561996e-01	2.216609e-01	-1.328178e+00	-7.873882e-01	-4.670089e-01	-2.471774e-01	8.150995e-01	2.552524e-01
-1.220866e-01	1.250743e-01	-3.118542e-01	-2.727612e-01	-1.533150e-01	-5.668638e-01	-5.417359e-01	1.082907e+00	-7.007460e-01	5.900972e-01	-5.064050e-01	6.121728e-01
-1.760800e-01	-5.038458e-01	1.763683e-01	1.126477e-01	-6.646736e-01	-8.819530e-02	-4.862010e-01	-2.521276e-01	5.478161e-01	1.013535e+00	1.511677e-01	6.255826e-01

Masked MSA Multihead Attention block *out* bias

1	2	3	4	5	6	7	8	9	10	11	12
1.305126e-01	3.493060e-01	-2.620194e-01	-4.220919e-02	-4.452164e-01	6.638800e-02	-1.422704e-02	-2.829463e-01	2.971412e-01	3.402972e-01	2.962492e-01	-2.501954e-01

4. Residual Connection

$$\text{input_x2} = \text{attn_out} + \text{input_x}$$

(in this case, input_x is position embedded matrix)

5. Calculate LayerNorm 2

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \widehat{x_i} = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}\ \text{(ε=1e-5)}$$

$$\boldsymbol{h_1} = \mathrm{LN}(x)_i = \boldsymbol{\gamma_2}\,\widehat{x_i} + \boldsymbol{\beta_2}$$

***** In this case, h1 has shape of (n * 12)

MLP block Layer Norm weight(γ_2)

1	2	3	4	5	6	7	8	9	10	11	12
1.506261e+00	1.336491e+00	1.575295e+00	1.384330e+00	1.284732e+00	1.276426e+00	1.215312e+00	1.213865e+00	1.051055e+00	1.141071e+00	1.277975e+00	1.316890e+00

MLP block Layer Norm bias

1	2	3	4	5	6	7	8	9	10	11	12
2.702664e-02	-5.897957e-03	1.807868e-01	8.363684e-02	-2.029059e-01	2.816897e-01	-9.424451e-03	-7.911934e-01	8.365113e-01	1.063401e-01	6.450757e-01	-2.760139e-01

6. Calculate First MLP Layer

$$\boldsymbol{h_3} = \boldsymbol{h_2 W_1} + \boldsymbol{b_1}$$

*In this case, h3 has shape of (n * 48)

First MLP Layer Bias (MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-2.339137e-01	-1.335417e-01	-2.321306e-01	-9.673117e-02	-1.805049e-01	-4.559627e-01	-7.803965e-02	-2.276850e-01	-1.471694e-01	-3.526739e-01	-4.948885e-02	-3.346940e-01
-1.670950e-01	-9.576345e-02	2.555533e-01	-3.137249e-03	2.140468e-01	7.568748e-02	-3.297214e-01	-1.501297e-02	-2.217852e-01	-2.187582e-01	-4.554493e-01	8.551886e-02
-1.881120e-01	-4.257603e-01	-2.165808e-02	-2.354921e-01	-1.060185e-02	-8.782493e-01	-9.980758e-01	-2.274001e-02	1.395253e-01	-3.786539e-01	-2.452119e-01	-2.644412e-01
1.152479e-01	-2.143915e-01	-4.781533e-01	-1.723182e-01	-1.397481e-02	2.494209e-02	-3.183931e-01	-2.492628e-01	-8.470304e-01	-7.918781e-02	-2.157585e-01	-6.531413e-01

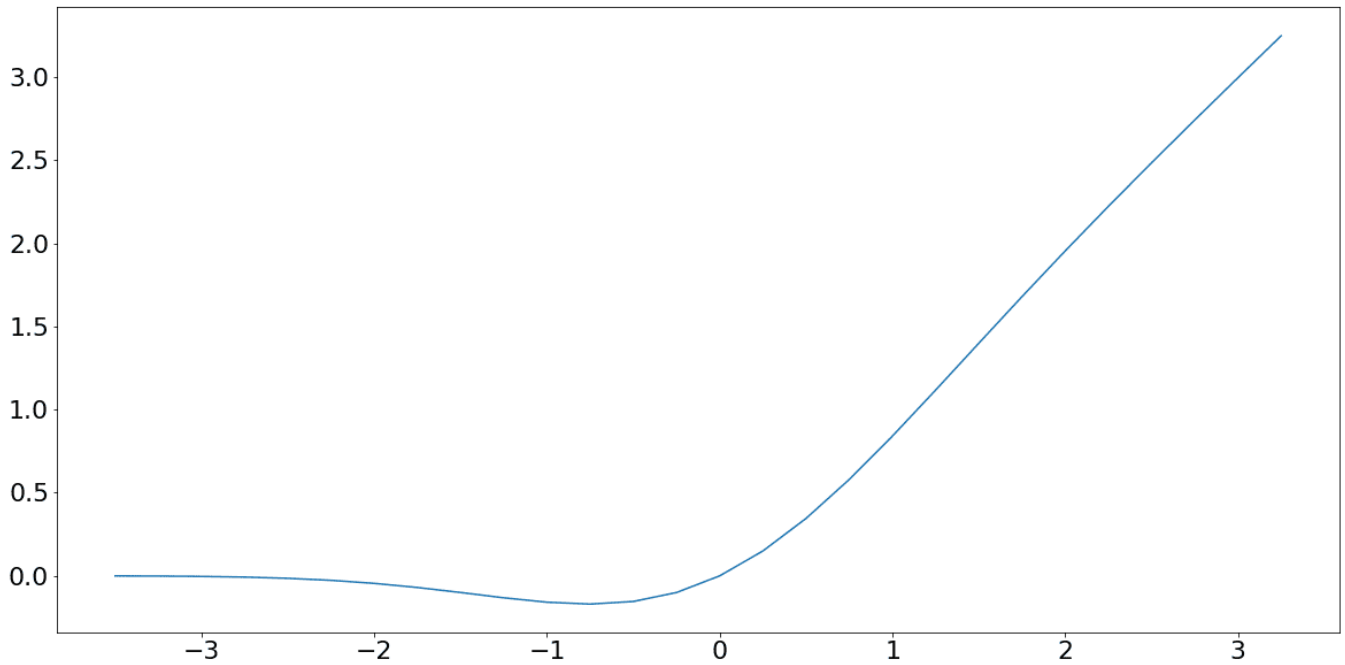
First MLP Layer Weight (b_1, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-7.407061e-01	4.702148e-01	2.713484e-01	-1.799508e-01	1.344510e-01	1.866560e-02	3.235848e-01	2.358283e-01	-2.310996e-01	-2.264632e-01	-4.233081e-01	-2.450474e-01
-2.489743e-03	-3.248984e-01	-2.791735e-01	5.735516e-02	4.086262e-01	-4.765189e-01	1.021929e-01	3.580719e-01	-2.382749e-01	5.391040e-02	4.452822e-02	1.138576e-01
-1.486862e-01	-1.797611e-01	4.210825e-01	-2.125621e-01	4.697251e-01	1.534990e-01	-7.296807e-03	-9.180012e-02	-7.190162e-02	-5.133598e-01	-2.209944e-01	7.006421e-02
-1.202989e-01	-3.083666e-01	5.337428e-01	2.449735e-01	9.621754e-02	-1.338041e-01	-2.414719e-01	-3.379554e-01	-1.310363e-01	1.439107e-01	8.787300e-02	1.732044e-01
-4.687909e-02	-3.291337e-02	6.029262e-02	-1.912535e-01	-1.762818e-01	-4.393405e-01	-1.687801e-01	1.568416e-01	-7.225846e-02	4.660297e-01	2.518955e-02	3.320919e-02
4.861878e-01	1.589783e-01	-3.270771e-01	-4.816230e-01	1.762130e-02	-2.121203e-01	-3.906702e-02	3.396785e-01	1.133330e-01	-2.240796e-01	-2.577915e-01	2.423039e-01
-8.045047e-02	3.660443e-02	3.602804e-01	-3.085998e-01	-4.449233e-01	3.409116e-03	3.282234e-01	3.826178e-01	-1.016428e-01	1.748392e-01	-1.068578e-01	7.144103e-02
-3.245136e-01	-1.884530e-01	5.745633e-02	-3.619990e-02	-6.286188e-02	-2.231804e-01	-2.147381e-01	6.880161e-02	1.535734e-01	-2.364328e-01	-9.809998e-02	4.505635e-01
4.261726e-01	3.188099e-02	-3.084119e-01	1.988657e-02	-1.045836e-02	2.064568e-01	-1.085252e-01	2.018877e-01	2.345233e-01	-9.903613e-02	-2.169930e-01	-3.895813e-01
1.535817e-01	-2.025887e-01	5.743621e-01	-1.855579e-01	1.201996e-01	-5.433149e-01	9.473538e-04	2.620350e-01	-2.003645e-01	-1.946524e-01	-5.549622e-01	2.926672e-01
-5.813182e-02	8.230741e-02	7.125783e-01	-1.234106e-01	1.154552e-01	-4.849564e-01	-2.342354e-01	5.262154e-02	-5.267454e-02	8.728728e-02	-3.950168e-01	-3.451814e-02
-3.596957e-01	3.374423e-01	3.430405e-01	-4.408689e-01	3.166744e-01	5.161041e-02	1.367296e-02	1.603829e-01	-6.390899e-01	1.133481e-01	-6.279639e-01	4.766116e-01
8.883238e-02	4.194605e-01	-8.828770e-02	-3.497084e-01	2.429130e-02	-1.106793e-01	-4.504205e-02	2.038002e-01	-8.694795e-02	-1.484802e-01	-5.603223e-01	3.679353e-01
-3.862476e-01	-1.366832e-01	1.665928e-01	-1.586758e-01	-1.301158e-02	-2.440480e-01	-8.813071e-02	2.809718e-01	1.157605e-02	-1.701626e-01	3.041275e-01	6.397910e-02
2.695064e-01	-4.031811e-01	2.270512e-01	-8.399969e-02	6.013809e-02	2.850479e-01	2.246253e-02	4.591559e-02	6.562529e-02	9.712344e-02	-3.326552e-01	-1.418440e-01
-3.484127e-01	2.805697e-01	3.623149e-01	-1.326324e-01	2.159130e-01	3.811757e-02	-3.637732e-01	-1.173565e-02	3.980863e-02	-2.811807e-01	-7.253268e-02	2.811954e-01
-3.785990e-01	-3.015732e-01	2.199832e-01	3.033495e-01	5.275221e-02	4.741811e-02	-1.777889e-01	-1.064576e-01	-1.303774e-01	1.794993e-01	5.001018e-02	2.876362e-01
1.418262e-01	-1.963037e-01	4.982858e-01	8.464130e-02	1.860095e-01	1.356644e-01	-7.088648e-02	-3.259291e-01	-1.673065e-01	-6.907761e-02	-3.041023e-01	1.956723e-01
1.814731e-02	7.116257e-02	-5.760503e-02	-5.550635e-02	-2.851770e-01	3.258292e-02	-3.956380e-01	1.425603e-01	1.330466e-01	-5.451331e-02	1.615861e-01	5.977138e-02
1.144429e-01	7.409012e-02	-2.279594e-01	-2.248527e-01	-2.428160e-01	3.945536e-01	1.652821e-01	2.315444e-01	4.241380e-02	2.095838e-01	-5.275040e-01	-2.748956e-01
-4.792962e-01	8.157862e-02	-1.473468e-01	-2.425241e-01	1.427569e-01	-1.564671e-01	3.528306e-01	-2.352239e-01	-7.574485e-02	2.157804e-01	6.641296e-02	2.123792e-01
3.015468e-01	-1.985768e-01	-3.253153e-01	-5.821055e-02	-6.710839e-02	1.516340e-01	-2.184018e-02	-8.156923e-02	1.355909e-01	1.417644e-01	3.415047e-02	-2.367964e-02
7.307400e-03	-2.873502e-01	7.163115e-01	1.764667e-01	2.555310e-01	-4.321846e-01	-1.802530e-01	3.551832e-01	-1.184250e-01	-2.385116e-01	-3.919287e-01	-1.431664e-01
-7.333259e-02	-1.265280e-01	-1.674015e-01	-2.915837e-01	4.772856e-01	1.996907e-01	-3.428651e-01	3.843165e-01	2.638953e-02	-8.865451e-02	-1.997498e-01	-3.121891e-02
-1.326726e-01	-2.901825e-01	3.689658e-01	-2.198987e-02	1.162417e-01	1.582974e-01	-2.674635e-01	-2.660115e-01	-2.609375e-02	-8.730438e-02	7.679482e-02	3.969471e-01
2.074586e-01	3.718933e-01	6.953469e-02	-2.323151e-01	-1.618080e-01	1.227038e-01	2.183395e-01	6.200852e-01	-2.370164e-01	-4.685874e-01	-3.444547e-01	-4.036525e-01
-3.124726e-01	3.009162e-01	1.596655e-01	6.698740e-02	-3.701194e-01	6.775627e-03	1.415206e-01	-3.210892e-01	-3.793357e-01	2.392079e-01	1.440550e-01	3.306447e-01
-5.289526e-01	8.492662e-02	1.550998e-01	1.740164e-01	7.714523e-02	2.956419e-02	-5.579109e-01	1.495710e-01	1.852573e-01	-7.823360e-02	-4.327065e-02	2.429935e-01
-3.091394e-02	-4.245415e-01	6.330339e-01	1.385398e-01	-3.406857e-02	-1.657171e-01	-1.567448e-01	1.663400e-01	-1.553672e-01	2.219216e-01	-1.734841e-01	-1.722503e-01
-1.933587e-01	2.269061e-01	-1.525500e-01	3.117045e-01	-4.244782e-01	6.312243e-01	4.049089e-01	-3.720826e-02	-7.420081e-01	-2.529563e-02	-5.647349e-01	8.941483e-02
9.881948e-02	-2.826532e-01	-3.003183e-01	1.608679e-01	4.169333e-01	4.812082e-02	2.502727e-02	2.188138e-01	-8.192941e-01	1.787837e-01	-9.199651e-02	1.195772e-01
-9.218034e-02	-1.315614e-01	-1.365290e-01	-6.034234e-01	-2.715855e-02	2.822134e-01	4.322495e-02	-2.404650e-02	1.753347e-01	-3.564983e-01	-3.807891e-02	1.900479e-01
-4.581018e-01	-2.835265e-01	4.218572e-01	-8.890754e-02	1.041413e-01	5.223046e-01	2.433312e-01	-1.308332e-01	-2.499420e-01	1.624196e-02	-2.912079e-01	1.527668e-01
8.749620e-01	1.873917e-01	1.045297e-01	1.712498e-01	8.179878e-02	1.530729e-01	-1.663433e-01	2.408357e-01	-5.129641e-01	-4.068241e-01	-2.906059e-01	-2.935192e-01
-3.737443e-01	1.059792e-01	-1.453528e-02	-2.637602e-01	-1.103141e-01	1.977536e-01	-3.780900e-02	2.499827e-01	-6.307034e-02	2.080825e-01	-2.058939e-01	4.978796e-02
9.563524e-02	-2.724854e-01	2.126915e-01	9.571600e-03	-2.780310e-01	3.356584e-02	-2.949673e-02	6.706744e-01	-6.818178e-01	3.125199e-01	-1.068555e-01	1.290316e-02
7.913542e-02	-3.044167e-01	3.980410e-01	7.705400e-02	2.544962e-01	2.823303e-01	-3.035656e-01	-1.553687e-01	3.386861e-02	1.265234e-01	-6.275020e-01	5.358068e-02
1.181616e-01	3.933311e-01	2.194299e-01	1.974498e-01	6.571585e-02	-2.515440e-01	1.764872e-01	-1.151530e-01	-3.844381e-01	3.240893e-01	-2.258217e-01	-4.229819e-01
8.645783e-02	-1.406293e-01	-3.595277e-01	5.089123e-01	-9.240893e-02	-2.848134e-01	-2.704090e-01	1.020443e+00	-3.384250e-01	-9.304604e-02	-4.612235e-01	-1.502339e-03
9.281570e-02	3.274312e-01	-1.690026e-01	9.500383e-02	-4.052625e-02	2.095399e-01	5.788737e-02	-1.538408e-01	-8.142786e-02	1.025522e-01	-1.968418e-01	-1.512473e-01
1.537041e-02	-1.279123e-02	1.843490e-02	-5.231979e-01	3.668653e-01	-2.599524e-01	2.008303e-01	-1.276911e-01	2.195743e-01	-1.327781e-01	1.467298e-01	-1.794559e-02
2.136119e-01	-5.357870e-01	5.227472e-02	-4.600507e-01	3.239617e-01	-5.296540e-02	-9.913477e-02	-5.315251e-02	4.279814e-01	-8.946622e-02	-1.250669e-01	2.633129e-03
-4.015198e-01	-2.280402e-02	-4.237192e-01	6.499697e-02	-1.466075e-02	3.905968e-01	-2.433057e-02	1.770662e-01	-8.328298e-02	-2.521038e-01	1.674003e-01	-2.183373e-01
7.161310e-02	3.350707e-01	7.563150e-02	6.961046e-02	-5.072309e-01	9.271584e-02	-3.068888e-01	1.686185e-01	-9.923921e-02	3.691823e-02	-6.487819e-02	1.725377e-01
-4.263994e-02	1.106177e-01	-1.866426e-01	-2.320666e-01	4.661778e-01	-3.460136e-01	1.487696e-01	1.329359e-01	-6.634668e-01	4.017258e-01	-6.626162e-01	6.550444e-02
5.948720e-01	1.751780e-01	-2.851372e-02	-5.911214e-02	-1.863312e-01	5.775966e-02	-2.405526e-02	8.348931e-02	-5.857494e-02	-1.489794e-02	-8.177456e-03	-3.390396e-01
-8.407032e-02	-1.484541e-01	-7.093062e-02	3.361030e-01	2.669977e-01	-7.066280e-02	-2.964572e-01	-5.825283e-02	9.502517e-02	5.746680e-02	-4.981671e-02	-3.175727e-01
-1.876039e-01	-4.855688e-01	5.323206e-01	8.439375e-02	-2.220559e-01	1.890804e-01	-5.699826e-01	5.064149e-02	-1.735069e-01	-2.765486e-01	-1.478450e-01	5.660381e-01

7. GELU Activation Function

$$\boldsymbol{h_3 = GELU(h_3)}$$

*In this case, h3 has shape of (n * 48)



8. Calculate Second MLP Layer

$$\boldsymbol{h_4} = \boldsymbol{h_3 W_2} + \boldsymbol{b_2}$$

Second MLP Layer Weight (W_2, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-1.001900e-01	9.573150e-02	2.001865e-02	6.398644e-03	-8.704739e-02	2.520619e-02	-1.528755e-01	-2.103156e-02	3.518328e-01	-1.609405e-01	1.573184e-01	-3.092529e-02
5.811081e-02	-3.154481e-01	2.176723e-01	-1.807786e-02	-3.070042e-01	2.003009e-02	9.386827e-02	-3.244537e-02	-7.173909e-02	2.553182e-01	2.479120e-02	-4.966386e-02
-7.700775e-02	1.322476e-02	-8.820883e-02	-1.731340e-01	1.456881e-01	-2.150075e-01	-6.493449e-02	1.324209e-01	-1.644444e-01	2.060802e-01	-1.799051e-01	1.221655e-01
3.507537e-02	1.443712e-01	1.947217e-01	6.155910e-02	-4.719202e-02	2.046581e-01	-1.323490e-01	-4.052258e-02	-1.261590e-01	3.176828e-01	-1.009093e-01	-7.204355e-02
2.693501e-01	1.607902e-01	-2.557203e-01	-3.890818e-01	8.068238e-02	-1.118062e-02	1.261644e-01	8.399332e-03	4.964903e-02	-3.363835e-01	1.857069e-01	6.788755e-02
9.192804e-03	-3.820490e-03	-3.650165e-01	3.156689e-01	-5.009492e-01	-2.981642e-01	-1.899505e-01	8.675805e-02	7.522355e-02	-1.391195e-01	-1.271736e-01	-3.044436e-02
-3.518137e-01	5.976449e-02	1.330373e-01	1.300550e-01	-3.482774e-01	2.478135e-01	-6.601378e-03	4.455683e-03	-3.429554e-01	2.184441e-01	6.700184e-02	-6.095569e-02
-3.143157e-01	3.566917e-01	3.208302e-01	3.848317e-01	1.140289e-01	-3.022105e-01	-1.308777e-01	2.523021e-01	3.879063e-01	1.120343e-01	-8.206747e-02	1.482885e-01
8.239231e-03	5.066751e-02	5.294375e-01	1.868631e-01	4.494779e-02	-4.360750e-01	2.678881e-01	1.966770e-01	-1.480970e-01	-1.198953e-01	4.703106e-01	4.130470e-01
-3.191724e-01	1.675158e-01	1.011895e-01	1.471350e-01	1.197284e-01	4.456691e-01	7.686862e-03	-2.047042e-01	1.957769e-01	-3.364050e-01	1.515757e-01	8.326938e-03
1.090133e-01	-3.347990e-01	1.113266e-01	8.270128e-02	4.755110e-01	1.463695e-01	-2.379817e-01	-1.275725e-01	1.328388e-01	-1.252293e-01	3.104192e-02	1.278344e-01
8.968584e-02	-4.270653e-02	-2.694970e-01	-2.965172e-01	5.562755e-02	1.052662e-01	-3.794592e-01	8.330018e-02	8.849520e-02	5.733828e-02	1.233126e-02	-9.215771e-02
-4.001059e-01	2.682266e-01	1.509463e-02	3.049763e-01	-2.079641e-01	1.321010e-02	-1.985912e-01	1.043925e-01	8.290872e-02	1.769142e-01	-3.447292e-01	-1.577196e-02
5.350352e-03	2.357320e-02	7.498701e-04	-6.306037e-02	4.796336e-02	1.456480e-01	-1.002524e-01	2.470768e-02	-1.224672e-01	-1.536756e-01	2.266693e-01	-6.683125e-02
7.979627e-02	-3.687399e-01	1.218348e-01	1.317093e-01	1.356520e-01	4.714464e-01	2.928097e-01	-6.092766e-01	-9.149545e-02	-1.920645e-01	-3.453627e-02	-1.922166e-02
7.777356e-02	-3.137318e-01	7.097069e-03	1.104052e-02	-3.582885e-01	-2.556901e-01	-2.162398e-01	-9.973919e-02	2.794691e-02	-7.336335e-02	2.440193e-01	2.797066e-01
2.054067e-01	-3.578380e-01	1.468620e-01	2.349646e-01	-4.574813e-03	1.272237e-01	-4.359640e-01	2.208755e-02	1.041093e-01	4.388558e-01	1.762932e-01	-3.494963e-02
-1.877902e-01	2.448003e-03	-1.250853e-01	9.206844e-02	2.039811e-01	1.572626e-01	-2.380684e-01	-2.087109e-01	-1.058760e-02	6.465733e-02	1.960868e-01	1.893379e-01
2.153639e-01	1.198723e-01	-2.931992e-01	7.516059e-03	-5.660396e-02	8.849885e-02	4.406412e-01	-7.496878e-02	6.880966e-02	1.148522e-01	-2.493734e-01	-1.821197e-01
1.711047e-01	1.251518e-01	9.612910e-02	8.294780e-02	2.627338e-01	4.356048e-01	1.654836e-01	-2.955881e-01	2.402067e-01	-1.110195e-01	3.553458e-01	-5.977723e-02
-4.955898e-02	-1.391876e-01	-5.899129e-02	-2.247971e-01	-1.281264e-01	-1.299542e-01	-1.033085e-01	4.979230e-02	2.480288e-01	-2.369355e-01	-2.260818e-01	2.136836e-01
6.602324e-02	-2.704353e-02	5.850916e-02	2.423859e-01	6.522271e-02	-3.784789e-02	-1.563601e-01	1.880956e-01	-2.254918e-01	6.627198e-02	1.046849e-02	1.367362e-01
1.783085e-01	1.289343e-01	1.447652e-01	2.347179e-01	-7.937696e-02	2.362113e-01	2.918994e-01	2.873047e-01	1.696763e-01	-5.324769e-02	2.631712e-01	-3.681649e-02
3.348752e-02	-2.968041e-01	-5.946373e-02	1.282106e-01	-3.345774e-01	-7.380527e-02	-5.444933e-02	-1.680044e-01	-1.238607e-01	3.294440e-02	-6.145305e-02	-9.587910e-02
2.723045e-01	-1.698807e-03	1.345286e-01	-1.216680e-01	-4.811804e-02	2.328965e-01	3.271082e-01	1.338285e-01	-1.213321e-01	6.475700e-02	1.214756e-01	-7.199297e-02
6.412013e-02	-1.778480e-02	1.389401e-01	-1.369909e-01	-1.540729e-01	-8.390867e-02	-3.282119e-01	2.097541e-02	1.847607e-01	2.075156e-01	-1.590512e-01	-1.468552e-01
-6.408008e-02	4.807422e-02	7.551344e-02	-3.035340e-01	9.506208e-02	1.737473e-01	3.918855e-01	2.351356e-01	3.598003e-01	-2.323225e-01	6.630446e-02	5.637794e-02
-8.071034e-02	1.261248e-01	3.169872e-01	-1.195279e-02	1.921837e-01	1.183652e-01	1.304888e-01	-3.456403e-01	2.301244e-02	-5.833953e-02	-1.268284e-01	3.226210e-02
1.375034e-01	3.551999e-02	-2.721040e-01	-1.341755e-01	-5.097118e-03	8.346883e-02	1.419445e-02	-3.659086e-02	1.260853e-01	-1.974557e-02	-4.310500e-02	1.042166e-01
-7.941066e-02	-1.059815e-02	4.786863e-02	-1.000667e-02	-1.173575e-01	-1.634201e-01	6.346902e-02	1.042948e-01	-2.112149e-01	-1.933932e-01	5.081375e-02	1.003526e-01
-2.187940e-01	1.055615e-01	-1.031295e-01	1.159079e-01	4.517388e-02	4.060474e-01	-5.807969e-02	-1.014466e-01	6.633941e-03	5.533603e-03	1.170136e-01	4.457420e-01
-2.910607e-04	7.862720e-02	-4.157287e-01	-1.086658e-01	-8.655859e-03	1.178228e-02	8.993856e-03	-2.669697e-02	1.355190e-01	-8.933140e-02	-1.431681e-01	2.209063e-01
2.798193e-01	3.591115e-01	-1.253376e-01	-1.592516e-01	-3.653444e-02	-6.164820e-02	-1.526254e-02	8.858134e-02	2.497247e-01	-1.609668e-01	-8.896314e-02	1.378489e-01
-2.156219e-01	1.541410e-01	3.422294e-02	-6.181699e-02	6.497209e-02	-1.401898e-01	2.629982e-01	-1.085840e-01	-1.971260e-01	2.913640e-01	-2.602851e-02	2.086662e-01
-1.613535e-01	4.545048e-01	-2.558958e-01	3.187943e-01	-1.373879e-01	-3.041355e-01	-4.773759e-01	1.412365e-01	-1.687407e-01	-2.227959e-01	9.227125e-02	3.178653e-02
-4.859428e-02	-1.516803e-01	-4.482586e-01	-2.064303e-01	2.966486e-01	4.886375e-01	-3.338425e-03	-6.461766e-02	2.179467e-01	-1.023794e-03	-6.478142e-02	-4.278761e-01
-1.145445e-01	-2.371357e-01	-5.563863e-02	-4.570931e-03	3.189014e-01	-7.423902e-03	-2.210494e-02	-1.299923e-01	7.294966e-02	7.990742e-02	-3.268691e-02	2.388134e-01
-2.265776e-01	1.960553e-02	-1.335674e-01	-1.527418e-02	1.887652e-01	-2.826084e-02	-1.004604e-01	1.079457e-01	-8.472058e-02	2.128719e-01	8.255862e-02	-3.610107e-03
-1.358309e-01	-6.230179e-01	2.577787e-01	-6.111281e-02	-4.155640e-02	-6.128101e-02	1.211711e-01	-1.903097e-01	-3.233748e-02	-3.462576e-01	1.813898e-02	1.357240e-01
7.971001e-02	-5.986970e-02	2.423960e-02	1.000202e-02	-1.670472e-01	-2.272098e-02	-2.180628e-01	-7.817398e-02	4.108184e-01	-1.452578e-01	8.142355e-02	-3.274282e-01
-1.643790e-01	-2.034982e-01	-6.432073e-02	6.878307e-02	5.809408e-02	-1.000704e-02	5.821665e-02	-2.794458e-01	-2.077595e-01	6.782206e-02	-3.231739e-01	-3.274964e-01
1.025315e-01	5.020021e-01	-4.212791e-01	-1.022338e-01	-9.397118e-02	-9.650169e-02	2.447532e-01	-2.632615e-01	1.829671e-01	6.788112e-02	-2.962983e-01	-1.191733e-01
1.094645e-01	4.086205e-01	3.185429e-01	-1.625232e-01	-3.198189e-01	2.080289e-02	4.083220e-01	1.353575e-01	-1.724747e-01	2.523609e-02	-2.655759e-01	1.343497e-01
-7.814331e-01	9.595106e-03	-2.370389e-02	-4.886037e-02	3.052009e-01	-2.683413e-03	1.445575e-01	1.323780e-01	-2.629035e-01	1.321469e-01	1.532616e-01	2.425803e-01
-4.965171e-02	2.199712e-01	-9.144165e-02	9.644609e-02	-3.930572e-02	2.423394e-02	-5.094026e-02	-4.232626e-02	-2.944301e-01	1.267468e-01	1.466083e-01	-7.123435e-02
2.468563e-02	-9.511229e-02	-1.954282e-01	8.070748e-02	2.123200e-01	1.699228e-02	2.643239e-01	1.079883e-01	2.629357e-01	-4.166730e-02	5.420226e-04	-1.780213e-01
1.174035e-01	9.191134e-02	1.002374e-01	1.183300e-01	-1.958878e-01	5.834109e-02	-2.718769e-01	2.155416e-01	9.880982e-02	-5.945246e-02	-4.263182e-02	-2.016584e-01
-7.378770e-02	-8.672845e-02	2.633601e-01	-2.304027e-02	-2.121707e-03	-1.129749e-01	4.068375e-02	2.449576e-01	-2.706168e-01	-8.684234e-02	-2.215243e-01	1.268921e-01

Second MLP Layer Weight (MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-6.939995e-02	5.329966e-02	-1.058112e-01	3.569480e-02	-4.951483e-02	-3.812562e-02	7.017172e-04	9.182575e-02	-6.459156e-02	-6.986209e-03	-2.252200e-02	-5.476198e-02

9. Residual Connection

$$\text{input_x3} = \text{input_x2} + \text{h4}$$

(in this case, input_x2 is value before LayerNorm2)

Layer 4

From now on, this is the repeat of layer 3.
However, the input is the result of Layer 3, which is **input_x3**

1. Calculate LayerNorm 1

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} \boldsymbol{x_i},\ \boldsymbol{\sigma^2} = \frac{1}{d}\sum_{i=1}^{d}(\boldsymbol{x_i} - \boldsymbol{\mu})^2,\ \widehat{\boldsymbol{x_i}} = \frac{\boldsymbol{x_i} - \boldsymbol{\mu}}{\sqrt{\boldsymbol{\sigma^2} + \boldsymbol{\varepsilon}}}\ \text{(ε=1e-5)}$$

$$\boldsymbol{h_1} = \mathrm{LN}(\boldsymbol{x})_i = \boldsymbol{\gamma_i}\,\widehat{\boldsymbol{x_i}} + \boldsymbol{\beta_i}$$

***** In this case, h1 has shape of (n * 12)

Masked MSA block Weight

1	2	3	4	5	6	7	8	9	10	11	12
1.458215e+00	1.463444e+00	1.429149e+00	1.423266e+00	1.250993e+00	1.301825e+00	1.567622e+00	1.415227e+00	1.372509e+00	1.447445e+00	1.250621e+00	1.407622e+00

Masked MSA block Bias

1	2	3	4	5	6	7	8	9	10	11	12
-1.358639e-01	3.165627e-02	-8.581208e-02	1.724824e-02	8.328643e-02	-3.852352e-01	9.926006e-02	-3.757887e-02	-2.403430e-01	-5.805424e-02	-2.048842e-01	-1.027538e-01

2. Calculate Q,K,V, Multihead attention

$$\mathbf{Q} = \boldsymbol{h_1}\mathbf{W_Q} + \boldsymbol{b_Q},\ \mathbf{K} = \boldsymbol{h_1}\mathbf{W_K} + \boldsymbol{b_K},\ \mathbf{V} = \boldsymbol{h_1}\mathbf{W_V} + \boldsymbol{b_V}$$

*Perform a single 12×12 multiplication. (You can also compute by splitting into n*12)

Masked MSA Multihead Attention block *in* Q, K, V weight

Query Weight											
-3.336618e-02	7.307779e-02	2.094480e-01	8.678719e-03	1.863624e-02	5.136984e-01	4.020051e-02	-5.008458e-01	1.056736e-01	1.913576e-01	-8.593281e-03	-5.377133e-01
-7.102013e-02	4.301113e-02	6.215170e-02	2.096236e-01	-3.152834e-01	-1.854148e-01	2.555281e-01	-3.369022e-01	4.560254e-01	-3.800937e-01	3.213911e-01	3.497430e-01
-1.269987e-01	-9.052202e-02	-1.689202e-02	7.380855e-02	4.345514e-01	9.885891e-02	-1.842172e-01	-3.815867e-01	4.000248e-01	-3.411806e-02	-6.790594e-01	1.099839e-01
3.608789e-01	2.047893e-01	-1.524902e-01	2.030057e-01	6.341521e-02	-4.579226e-02	5.358309e-01	3.403797e-02	-8.239495e-02	1.066639e-01	-4.414828e-01	-5.111243e-01
-3.136679e-01	-6.621510e-01	2.329299e-01	2.513819e-02	2.878784e-01	8.561339e-02	3.078186e-01	-8.321543e-01	3.517295e-01	-1.125937e-01	1.858356e-01	-9.192015e-02
-1.816483e-01	9.918951e-02	8.480468e-02	-4.288044e-01	3.327962e-01	-1.156491e-01	-5.019833e-01	9.287889e-02	-2.488813e-02	2.815211e-01	4.092258e-01	-3.817542e-01
1.904690e-02	9.548030e-01	6.839263e-02	1.186619e-01	-5.936542e-01	2.718283e-01	2.647716e-01	-7.803497e-01	2.093587e-01	-2.972719e-02	2.380706e-01	-6.150394e-01
-7.623821e-02	2.301846e-01	2.991142e-02	3.352084e-01	1.356331e-01	-8.335054e-01	-2.391972e-01	5.806390e-02	6.583215e-01	-2.895051e-01	2.583158e-01	1.074182e-01
-1.696328e-01	1.807261e-01	1.033601e-01	-1.381451e-01	7.753477e-02	4.631180e-01	-1.782909e-01	1.195162e-01	1.256622e-01	-2.546404e-01	-2.798711e-01	1.953496e-02
1.541669e-01	3.539825e-01	-1.593948e-01	4.980575e-02	-1.590764e-01	-2.326527e-01	2.667371e-01	-6.219754e-02	-5.292523e-02	-3.088117e-01	1.080559e-01	2.799854e-01
-7.273728e-02	-3.328065e-02	2.331092e-01	-2.497078e-01	-2.849884e-01	3.918473e-01	3.261112e-01	5.406744e-02	-2.820749e-01	7.698984e-02	-5.050879e-02	5.921182e-02
-5.036518e-03	8.702681e-02	-1.139705e-01	-1.186216e-01	-2.811531e-01	-9.222057e-02	-6.385113e-02	-7.930146e-02	6.765837e-02	-1.146246e-01	-1.183018e-01	3.569764e-01
Key Weight											
-2.336561e-01	-5.429694e-02	5.746371e-01	-2.984619e-01	-2.569328e-01	1.908454e-01	1.474066e-01	-7.736810e-01	5.530822e-01	-5.912734e-02	2.724263e-01	-4.574540e-02
2.202852e-01	-1.054905e-01	-2.847105e-01	4.238989e-01	-3.619812e-01	-2.033854e-01	8.874188e-02	9.502814e-02	4.989996e-01	-4.036045e-01	-2.118256e-01	8.674614e-02
-1.135122e-01	2.927800e-01	1.263660e-02	-2.903121e-01	-3.826191e-02	-1.960930e-01	6.820650e-01	-1.200792e-01	-1.172365e-01	-2.720714e-01	-3.760321e-02	6.424744e-02
-1.538543e-01	-4.357303e-01	5.498429e-01	8.976770e-02	3.539187e-01	-6.031747e-01	3.212569e-02	-1.608170e-01	-1.307287e-01	-5.840592e-03	-3.843780e-02	1.852389e-01
-1.105515e-01	-1.569398e-01	-2.407776e-01	-4.564327e-01	-4.391087e-01	6.091647e-02	3.027206e-01	-3.043164e-01	7.337332e-01	-1.682532e-01	8.070192e-01	4.718095e-01
-4.288348e-01	8.051032e-01	1.696213e-03	-2.376302e-01	-3.638903e-01	5.568781e-01	-5.136786e-01	-1.425109e-01	-2.228325e-01	3.186181e-01	5.035289e-01	-1.842418e-01
-3.359190e-01	6.645427e-02	7.051926e-01	1.578869e-02	-1.021648e-02	-1.131633e-01	1.560864e-01	-7.436604e-01	4.390702e-01	-2.459109e-01	-1.184068e-01	-2.575208e-01
-2.511050e-01	5.270276e-01	-2.384357e-01	7.904853e-01	-5.175995e-01	-3.292604e-01	-1.498706e-01	3.042511e-01	1.151336e-01	-5.981798e-01	-3.195230e-01	3.123964e-01
-3.225083e-01	3.263148e-01	2.149561e-01	-2.216646e-01	1.060791e-01	2.159901e-01	-3.749361e-01	1.248750e-01	8.830497e-03	-3.800415e-02	7.735326e-02	5.947044e-02
2.122089e-01	1.876835e-01	-7.742295e-02	3.310193e-02	1.164716e-02	-4.255324e-01	4.644585e-02	1.737862e-01	-2.585222e-01	-3.197967e-01	-9.723674e-03	3.623211e-01
-2.423319e-01	3.020115e-01	4.714529e-03	-3.172952e-01	-3.249044e-01	3.866093e-01	3.516473e-01	1.803217e-01	-2.858295e-01	7.687337e-02	-3.138705e-02	4.333322e-02
-1.158093e-01	5.386351e-02	-8.484332e-02	3.073884e-01	-4.390672e-01	-9.010261e-02	1.893743e-02	2.210675e-02	3.160686e-01	-2.639491e-01	-1.261150e-01	3.387169e-01
Value Weight											
2.131144e-01	4.009618e-01	-3.330750e-01	-4.408938e-01	-1.542794e-01	-2.116815e-02	5.285879e-01	1.188969e-01	3.815712e-01	-1.509777e-01	-2.409870e-01	-4.975489e-01
-8.017860e-02	1.609334e-01	4.325060e-01	-2.830649e-01	1.214339e-01	2.325587e-02	6.984507e-01	-3.846758e-01	-5.010485e-01	-3.030936e-01	-8.752122e-02	2.296325e-01
8.535711e-01	-1.160691e-01	-3.676654e-01	-4.542070e-01	1.111983e-01	1.928880e-01	-1.931883e-03	9.890162e-02	3.650254e-01	-3.247297e-01	2.195705e-01	-1.441019e-01
2.395733e-01	-2.382023e-01	-2.722802e-01	3.708222e-01	-1.199183e-01	2.707932e-01	-4.788445e-01	2.497749e-01	-3.017395e-01	6.829732e-02	-1.603439e-01	1.049396e-01
-2.766185e-01	3.452824e-01	-1.572511e-01	1.454568e-01	1.524996e-01	-2.972140e-01	-2.496350e-01	4.505471e-01	7.912761e-02	-5.489102e-01	-3.033153e-02	-4.649679e-01
-4.184409e-01	5.090054e-01	1.558273e-01	5.864885e-01	-2.219466e-01	-1.037718e-01	-3.247909e-01	2.329466e-02	-6.233053e-01	1.913833e-01	-9.652625e-02	1.587781e-01
-3.961381e-01	2.277052e-01	7.490599e-01	-6.794017e-01	3.432999e-01	-3.876279e-01	4.394237e-01	-5.816382e-01	2.756262e-01	-5.143557e-01	2.838209e-01	6.155608e-01
1.063923e-01	-1.619899e-01	3.022506e-01	-3.085461e-01	6.360537e-01	-2.081084e-01	2.776975e-01	6.000838e-02	6.327707e-02	-8.053851e-02	-4.428005e-01	-4.138683e-01
5.243261e-01	-2.499215e-01	-6.112759e-02	2.369355e-01	3.613388e-01	-1.061810e-01	-8.130360e-02	6.401367e-02	-1.641603e-01	1.045921e-01	1.749333e-02	-2.519978e-01
6.125540e-01	-5.780874e-02	-4.462393e-02	4.252006e-01	-3.096268e-01	-1.260272e-01	2.595198e-01	-3.355076e-01	6.035214e-01	6.567093e-02	-2.004617e-02	1.956172e-01
-2.921592e-01	-1.801238e-01	-8.832823e-02	-1.172483e-01	-2.864251e-02	4.068063e-01	7.224910e-01	3.480462e-02	-3.282504e-03	5.600777e-01	-1.765087e-01	-2.218091e-01
-3.923094e-01	-2.880414e-01	1.041158e-01	2.761835e-01	4.131325e-02	6.014463e-02	-1.515595e-01	-3.434376e-01	5.676873e-01	9.619990e-02	-1.530307e-01	-1.772419e-01

Masked MSA Multihead Attention block *in* Q, K, V bias

Query Bias											
1.847811e-01	1.703554e-01	-2.140412e-01	-1.082390e-01	7.005569e-01	1.023555e-01	2.246431e-01	-4.569552e-01	-8.605098e-02	-1.989951e-01	-2.897147e-02	6.178432e-01
Key Bias											
-3.081083e-02	-5.456259e-02	1.295343e-02	-2.183667e-02	-1.291216e-01	7.636792e-02	1.206049e-01	-3.734107e-02	7.430408e-03	-2.060636e-02	7.015564e-02	6.708156e-02
Value Bias											
8.934123e-02	3.536984e-01	1.872270e-02	3.935791e-02	-6.202467e-02	4.040784e-01	-5.102294e-01	4.250880e-01	1.718299e-02	-3.366733e-01	2.564412e-02	1.381274e-02

$$\text{QK Score} = \frac{QK^T}{\sqrt{d_k}} \Rightarrow \text{Casual Mask(Upper triangle)} \Rightarrow A = \text{softmax} = \frac{exp(QKScore)}{\sum \text{exp(QKScore)}} \Rightarrow Attention\ Score = A \cdot V$$

*In this case, Multihead(Q,K,V) has shape of (n * 12)

If you calculate with 3 divided heads, you need to concat each heads.

$\mathbf{head_i = A_i V_i,\ i = 1, 2, 3}$ **Multihead(Q,K,V) = Concat(**$head_1, head_2, head_3$)

3. Calculate attn_out score

$$\text{attn_out} = \text{Multihead(Q,K,V)} \cdot \boldsymbol{W_O} + \boldsymbol{b_O}$$

Masked MSA Multihead Attention block *out* weight(W_O)

1	2	3	4	5	6	7	8	9	10	11	12
-9.801374e-02	-3.578707e-01	1.312597e-01	-1.955681e-01	1.765530e-01	-1.354076e-01	-1.912541e-01	1.281650e-03	7.404264e-02	1.999018e-01	6.767318e-02	-3.670009e-01
-3.939244e-01	5.716508e-01	-2.807944e-01	-5.163181e-02	3.573954e-01	5.017658e-01	3.957895e-01	3.022109e-01	-2.505264e-02	2.016470e-01	-4.288531e-01	-2.536830e-02
2.543949e-01	4.571468e-01	-6.953181e-01	-5.491031e-02	-5.744328e-02	1.643471e-01	-6.817882e-02	1.692621e-01	-1.877144e-01	1.148598e-01	2.446896e-01	5.624747e-01
-2.870822e-01	-5.362307e-01	-9.606065e-02	2.724842e-01	4.029868e-02	2.542123e-01	-5.482429e-01	-4.742019e-01	5.262833e-01	9.917699e-02	4.203142e-01	1.853572e-01
1.073997e-01	4.845926e-01	1.097417e-02	-6.420212e-01	-1.248184e-01	-1.627429e-01	6.248393e-01	-3.629765e-01	8.035030e-01	-3.141823e-01	-3.688802e-01	4.361274e-01
6.810845e-01	1.286806e-01	2.595489e-01	-4.077342e-01	2.143350e-01	-4.890030e-01	-2.106132e-01	4.550616e-01	-8.823615e-01	1.478893e-01	-1.747465e-01	2.883518e-01
-6.159213e-01	2.261946e-01	-3.252428e-01	-1.675852e-01	-4.024347e-01	-6.004952e-02	-2.438198e-01	1.234189e-01	-4.535520e-01	-1.444479e-01	7.619237e-01	-3.446315e-01
1.941817e-01	-1.905416e-01	5.618314e-01	2.144715e-01	-1.571761e-01	-2.387096e-01	2.386239e-01	3.156302e-02	1.637698e-03	-2.785412e-01	-5.373078e-01	-4.585020e-01
-2.648098e-01	-2.294587e-01	-7.542020e-01	1.979015e-01	2.674588e-01	8.147826e-01	-9.503420e-01	-2.349603e-01	1.789421e-01	1.007601e-01	5.881946e-01	9.455259e-01
6.289387e-01	-1.498046e-02	3.470444e-01	-4.981950e-01	2.761702e-01	-4.372341e-01	9.804690e-02	3.221408e-02	-5.348438e-02	3.480203e-01	-1.806201e-01	3.145395e-01
2.350551e-01	-1.423095e-01	2.618307e-01	4.530314e-01	5.720775e-01	-8.487263e-02	9.327213e-02	-1.234895e-01	2.881182e-01	5.444154e-01	-1.115423e-01	-2.058974e-01
-9.983974e-02	1.648085e-01	3.022950e-01	6.427335e-02	-4.586047e-01	-3.527155e-01	1.105006e-01	-6.996971e-02	-3.706842e-01	-3.060291e-01	-1.447432e-02	-3.647243e-01

Masked MSA Multihead Attention block *out* bias

1	2	3	4	5	6	7	8	9	10	11	12
4.913821e-01	-1.450489e-01	-3.232883e-01	-2.189465e-01	-4.017782e-01	1.416263e-02	-2.368885e-01	2.252333e-01	6.117298e-01	-1.500485e-01	3.771459e-01	1.238598e-01

4. Residual Connection

$$\text{input_x2} = \text{attn_out} + \text{input_x}$$

(in this case, input_x is position embedded matrix)

5. Calculate LayerNorm 2

$$\boldsymbol{\mu} = \frac{1}{d}\sum_{i=1}^{d} x_i,\ \boldsymbol{\sigma}^2 = \frac{1}{d}\sum_{i=1}^{d}(x_i - \boldsymbol{\mu})^2,\ \widehat{x_i} = \frac{x_i - \mu}{\sqrt{\sigma^2 + \varepsilon}}\ \text{(ε=1e-5)}$$

$$\boldsymbol{h_1} = \mathrm{LN}(x)_i = \boldsymbol{\gamma_2}\,\widehat{x_i} + \boldsymbol{\beta_2}$$

***** In this case, h1 has shape of (n * 12)

MLP block Layer Norm weight(γ_2)

1	2	3	4	5	6	7	8	9	10	11	12
1.622987e+00	1.219577e+00	1.401524e+00	1.269800e+00	1.337484e+00	1.330642e+00	1.471047e+00	1.581091e+00	1.235888e+00	1.450371e+00	1.307052e+00	1.654492e+00

MLP block Layer Norm bias

1	2	3	4	5	6	7	8	9	10	11	12
1.832695e-01	1.754968e-02	-1.208258e-01	2.658323e-01	-3.267767e-01	-2.480022e-01	-1.649831e-01	-4.405640e-01	2.718236e-01	-4.045325e-02	4.381487e-01	1.618518e-02

6. Calculate First MLP Layer

$$\boldsymbol{h_3} = \boldsymbol{h_2 W_1} + \boldsymbol{b_1}$$

*In this case, h3 has shape of (n * 48)

First MLP Layer Bias (MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-4.924934e-01	-2.522521e-01	6.632397e-02	3.858205e-02	-4.565489e-01	6.608301e-02	1.506560e-02	2.581410e-01	-2.246986e-01	-1.553286e-01	1.786142e-03	-7.943134e-02
-4.780445e-03	-2.467909e-01	-1.236851e-01	-3.422969e-01	-1.898925e-01	2.756123e-01	1.509177e-01	2.963639e-03	-7.807726e-01	-9.883624e-02	-3.588946e-01	-4.079152e-01
1.472205e-01	-5.060826e-01	-2.671350e-01	-3.344570e-02	-6.782183e-01	9.542701e-02	-1.660492e-01	-4.660834e-01	-5.533690e-01	-9.051205e-02	-1.053229e-01	-8.806627e-01
-2.322753e-01	-2.188329e-01	5.764171e-02	-6.218042e-02	9.470392e-02	-4.781679e-02	2.492606e-01	-2.128662e-01	5.672255e-01	-3.790032e-01	-7.852150e-01	-2.713441e-01

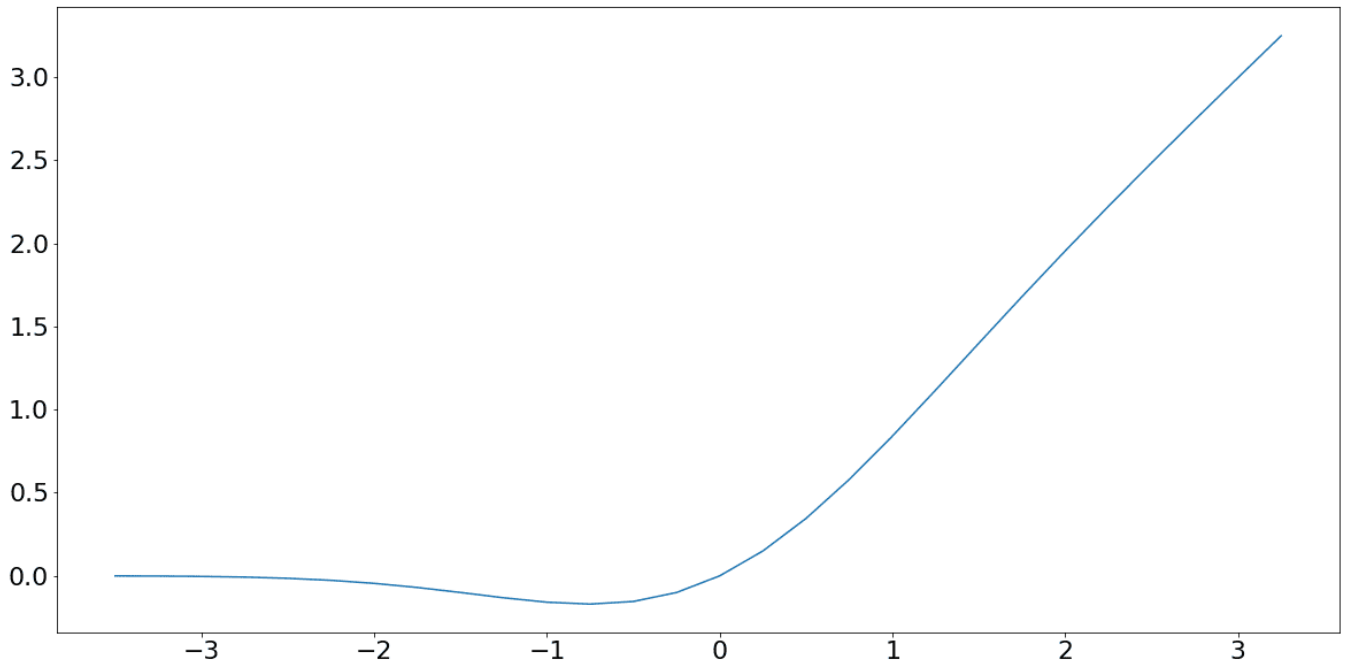
First MLP Layer Weight (b_1, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
-2.637191e-01	-2.813833e-02	2.291607e-01	5.446422e-01	2.260056e-01	-1.307056e-01	-2.669936e-01	5.383172e-01	-7.664817e-01	5.327525e-02	-9.387636e-02	1.819249e-01
-1.657337e-03	1.782143e-01	1.541241e-01	3.795701e-01	-7.270106e-02	2.759364e-01	-8.827160e-02	-3.285035e-01	-4.654697e-02	-2.961676e-01	-1.313276e-01	2.425700e-01
-4.490406e-01	-8.366251e-02	1.096333e-01	-1.438406e-01	-2.206576e-01	-1.806047e-01	1.167245e-01	3.035270e-01	4.835480e-02	7.032896e-01	-2.403251e-02	-2.175788e-01
-2.999882e-01	-2.464553e-01	2.608129e-01	3.821206e-01	3.958585e-01	-1.748682e-02	1.442930e-01	1.620427e-01	-3.640586e-01	-6.822290e-02	6.190488e-02	-6.248692e-01
2.858518e-01	-1.249765e-01	4.440550e-01	-1.309360e-01	-3.417305e-01	1.600635e-01	-4.272994e-01	-1.008153e-02	-2.840975e-02	1.132994e-01	2.715406e-01	-4.199425e-02
-5.298820e-01	3.554543e-02	-2.635209e-01	1.129354e-01	1.883860e-01	5.010656e-01	-2.978557e-02	1.119911e-01	2.220132e-01	3.524335e-02	-3.034295e-01	-3.920388e-01
-5.824890e-01	1.681643e-01	-8.147549e-02	-2.181929e-01	-7.210180e-02	8.091105e-03	-9.951419e-02	5.348358e-01	2.070427e-01	-5.352337e-02	1.805010e-01	-3.874501e-02
-4.222298e-01	2.453140e-01	-1.335148e-02	4.702771e-01	-3.038055e-01	1.989091e-01	-8.813578e-02	1.574067e-02	-2.584608e-01	1.677605e-01	6.902958e-02	2.191253e-01
-5.090658e-01	-1.690637e-01	-2.583026e-01	-4.252937e-02	2.555378e-01	2.534297e-01	1.848463e-01	-8.163569e-02	1.820267e-01	1.223638e-01	9.264962e-02	-4.259409e-01
-4.709928e-01	-5.773991e-01	4.371434e-01	-2.756967e-01	3.366279e-02	-5.248120e-02	-1.181697e-01	6.200731e-03	1.963837e-01	-1.924825e-01	4.996314e-01	5.367545e-02
9.369528e-02	1.338368e-02	1.024177e-01	4.281941e-01	7.940540e-02	4.808946e-01	-3.035357e-01	-3.611681e-01	-3.814579e-01	-1.384797e-01	-4.304876e-02	-3.855231e-02
-1.724022e-01	1.645003e-01	-1.295093e-01	6.318803e-02	3.756279e-01	3.741871e-01	3.736213e-01	-4.400197e-01	-2.539727e-01	-7.948272e-02	-2.425010e-01	1.661619e-01
9.886001e-02	-2.188111e-01	5.925996e-01	1.536390e-01	-2.847857e-01	3.620672e-01	-2.738509e-01	1.983023e-01	-1.516878e-01	-1.991454e-01	1.485659e-01	-1.231728e-01
3.080419e-01	-7.417642e-01	2.333095e-01	-1.338932e-01	4.505522e-01	-4.569519e-01	2.648991e-01	-1.790869e-01	1.913661e-01	-2.907816e-01	-5.546807e-02	1.677165e-01
-3.982188e-02	1.213066e-02	1.040519e-02	-2.111780e-02	3.160067e-01	6.025127e-01	-5.431210e-01	-1.273172e-01	1.775717e-01	-2.990326e-01	-3.790349e-01	8.228115e-02
1.902926e-01	3.799609e-01	2.418905e-02	5.124101e-01	-3.738706e-01	4.441434e-01	3.417177e-01	-1.983407e-01	-5.058155e-01	6.194786e-02	-4.956237e-01	-9.457797e-02
3.873688e-02	2.756663e-01	-5.948718e-02	1.368825e-01	-1.823416e-02	4.521748e-01	2.291566e-01	1.698290e-01	-3.404150e-02	-3.941259e-01	-1.055281e-01	-7.436507e-01
-9.423889e-02	6.755024e-03	2.972645e-02	-4.815823e-02	1.969210e-01	2.553997e-01	-5.480507e-02	-1.408571e-01	-2.194874e-01	-3.742731e-01	3.396214e-01	-4.994365e-01
-5.109699e-01	-2.987775e-01	2.171193e-01	1.336928e-01	-1.337969e-01	3.648258e-01	-9.504474e-02	2.812425e-01	-1.323884e-01	-1.838676e-01	2.946704e-01	-2.255761e-01
1.272599e-01	1.034965e-01	1.092662e-01	-9.330302e-02	8.355603e-03	-2.998487e-01	2.907803e-01	-7.244848e-02	-1.116921e-01	7.540456e-01	-1.190843e-01	-4.456947e-01
2.032065e-01	-1.454094e-01	1.020881e-01	-2.585165e-01	1.138556e-01	-1.123445e-01	3.129699e-01	4.176922e-01	-1.272095e-01	-2.389358e-01	-3.523959e-01	-1.900822e-01
-4.057726e-02	-3.262373e-01	8.455410e-02	-8.171124e-02	4.759797e-02	5.673133e-01	3.880140e-01	-1.586812e-01	-4.953795e-02	-1.071188e-01	2.658820e-01	-2.840677e-01
2.592110e-01	1.126333e-01	-3.124196e-02	3.106581e-01	6.349044e-01	2.820009e-01	-7.632186e-02	2.795294e-01	-9.609916e-02	-4.266103e-01	-6.208133e-01	-5.566867e-01
1.714356e-01	-3.586946e-02	5.783780e-01	-2.409249e-01	-2.872645e-01	-2.569887e-02	-3.604353e-01	3.088056e-01	2.004118e-01	-3.191576e-02	9.245266e-02	-7.193663e-03
-2.358050e-01	-1.274442e-01	6.667102e-01	6.546840e-02	-2.990712e-01	5.054334e-01	2.189202e-02	4.408875e-01	-1.355624e-01	-3.410235e-01	-1.496187e-01	-1.463264e-01
-3.513839e-01	-1.955736e-02	-8.038059e-02	2.329146e-01	-1.628705e-01	3.129166e-01	5.099688e-01	6.018437e-01	-4.757691e-01	-2.381556e-01	2.241284e-01	-5.438752e-01
-5.823176e-01	2.202416e-01	-2.629840e-01	1.466559e-01	6.403895e-01	1.209429e-01	2.647270e-01	2.371881e-01	-2.086482e-01	8.136904e-02	-3.085735e-01	-2.714416e-01
4.684844e-01	-4.062029e-01	5.060636e-01	7.617754e-01	1.563132e-01	-9.855225e-02	2.026368e-02	1.702558e-01	-6.126355e-01	-1.461105e-02	-7.035536e-01	-4.312925e-02
-2.394812e-01	-2.300928e-01	4.493466e-01	-3.106090e-01	6.628630e-01	9.743600e-02	2.646020e-01	-1.651565e-01	-5.341276e-01	-2.023160e-01	-1.274281e-01	2.364960e-01
-9.770866e-02	-1.062089e-01	1.683565e-01	2.463675e-01	1.974165e-01	6.811163e-01	-3.629913e-01	2.431767e-01	-1.612981e-02	-6.457257e-01	-6.335396e-02	-2.695669e-01
-4.706185e-01	1.248750e-01	5.560418e-02	-4.274891e-01	-3.297414e-03	1.587597e-01	-4.014980e-01	1.917175e-01	3.120731e-01	9.915926e-02	1.621902e-02	2.369247e-01
4.719662e-01	1.384489e-01	2.563610e-01	-1.462083e-01	1.168426e-01	2.486498e-02	-3.969482e-01	-2.427867e-01	6.300899e-02	3.521844e-01	-3.036365e-01	-8.419590e-02
-1.998892e-01	1.315301e-01	-2.216014e-01	3.406765e-01	2.111297e-01	2.504458e-01	7.576402e-01	1.460447e-01	-2.709989e-01	1.532875e-01	-3.665666e-01	-7.900199e-01
2.986008e-01	7.632912e-02	5.651687e-01	-2.835263e-01	-1.317230e-01	-7.915945e-02	-3.226650e-01	2.293583e-01	2.089919e-01	-3.185723e-02	-2.947487e-01	-2.380425e-01
1.640885e-01	-1.237128e-01	8.782372e-02	4.503644e-01	8.148474e-02	1.162205e-01	1.686886e-01	-3.277509e-01	-3.638099e-01	3.182732e-01	-9.377980e-03	-5.023225e-01
-2.924662e-02	4.162437e-01	-6.928534e-02	2.375034e-01	1.386350e-01	-1.134991e-01	5.335497e-01	3.260403e-01	-3.169512e-01	7.412253e-02	-2.637622e-01	-5.349687e-01
-4.372012e-02	-5.760938e-01	3.306231e-01	-3.599071e-01	2.811761e-01	-2.457753e-02	1.558225e-01	4.545535e-01	1.428389e-01	-2.117973e-01	2.401749e-01	-3.478113e-01
-3.426361e-01	-3.664684e-01	9.586193e-02	-1.467756e-01	2.198047e-01	2.221823e-02	-5.337670e-01	-5.934576e-03	6.112529e-02	4.221101e-01	3.237055e-01	7.674577e-02
-1.038097e-01	-5.839019e-02	1.058654e-01	-1.046269e-01	1.364696e-02	-1.516170e-01	2.753879e-01	4.666982e-01	2.259669e-02	1.941945e-01	7.294777e-02	-6.190637e-01
-2.695350e-01	2.201645e-01	2.764010e-01	1.901623e-01	-1.255091e-01	-5.163132e-04	-3.032748e-01	5.437351e-03	-1.506867e-02	7.039155e-01	-4.296076e-01	4.488157e-02
-3.430700e-01	-1.336065e-01	4.537687e-01	-4.197461e-02	-2.224746e-01	-3.202389e-01	-3.237078e-02	3.038009e-01	-1.284748e-01	4.371159e-01	4.645791e-01	-2.276091e-01
-1.518122e-01	-1.137956e-01	2.409565e-01	1.894911e-01	7.853254e-03	1.877242e-01	4.610326e-03	-4.606592e-01	-1.110547e-01	-7.074082e-02	2.478650e-01	2.882996e-01
-1.129311e-01	-6.277202e-03	5.895815e-01	1.239321e-01	4.592209e-01	-2.705249e-01	-4.582092e-01	2.040608e-01	-9.857029e-02	-1.783033e-02	-5.039640e-02	-1.461760e-01
-5.295823e-02	-3.212816e-01	-9.102784e-02	-3.743387e-01	6.302743e-02	-2.049963e-01	-1.307907e-01	8.366487e-02	2.193427e-01	5.863143e-02	3.524197e-01	-1.772806e-01
-3.389960e-01	2.636162e-01	4.123069e-01	2.528736e-02	-7.555921e-02	5.322082e-02	1.607444e-01	4.668107e-01	2.833112e-03	5.246227e-02	-2.619331e-01	-5.940316e-01
-3.017257e-01	3.163011e-02	-4.739012e-01	2.921863e-01	3.513486e-01	3.352450e-01	4.685448e-01	-1.774258e-01	-9.191497e-02	2.160645e-01	-2.266037e-02	-4.131266e-01
-1.802679e-01	-6.344632e-02	-3.019988e-01	1.627744e-01	1.783289e-01	2.152026e-01	3.392406e-01	5.855375e-01	-3.132680e-01	9.581576e-02	-3.352728e-01	-8.034218e-02
-5.947017e-01	-1.238926e-01	-1.222140e-01	4.734711e-01	-3.298514e-01	1.902574e-01	1.653956e-01	2.833397e-01	-2.471762e-01	4.996631e-01	6.295997e-02	-3.082949e-01

7. GELU Activation Function

$$\boldsymbol{h_3 = GELU(h_3)}$$

*In this case, h3 has shape of (n * 48)



8. Calculate Second MLP Layer

$$\boldsymbol{h_4} = \boldsymbol{h_3 W_2} + \boldsymbol{b_2}$$

Second MLP Layer Weight (W_2, MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
2.217273e-01	1.133027e-01	-3.196297e-01	-9.840307e-02	2.689188e-01	-4.752865e-01	-3.237737e-01	-3.236059e-01	-5.499043e-01	-2.950560e-01	2.635692e-01	-2.183958e-02
-7.335449e-02	5.531641e-03	1.323749e-01	1.743747e-01	3.187521e-01	2.289189e-01	-5.157757e-01	1.426261e-01	-6.170610e-01	8.186173e-02	3.668916e-01	1.009434e-03
-4.583896e-02	6.971537e-02	-3.465885e-01	-2.874904e-01	1.886761e-01	-8.252855e-02	-2.060653e-01	5.971790e-01	2.066537e-01	4.114162e-01	3.164836e-01	4.895755e-01
-9.510979e-03	-2.439681e-01	3.258361e-02	7.182454e-02	-8.883783e-02	2.779018e-01	5.385316e-02	1.000407e-02	-7.645392e-02	-1.482136e-01	-1.435529e-01	-2.901480e-01
-2.058171e-01	-1.107119e-01	1.060309e-01	-1.290972e-01	-1.375879e-01	8.010866e-02	2.784211e-01	2.622758e-02	-5.599802e-02	-5.742429e-01	-5.385607e-02	-1.120007e-01
-2.130898e-01	9.149173e-02	5.806584e-02	3.313804e-01	-3.116261e-02	-2.067506e-01	-6.674829e-01	2.889967e-01	-2.986722e-01	-6.613690e-01	-7.258736e-02	5.692824e-02
-1.249496e-02	-2.041704e-01	3.395835e-01	-4.172975e-01	-2.361400e-01	-2.490772e-02	1.536386e-01	3.332504e-01	1.170874e-02	2.406465e-01	-1.235314e-01	9.303728e-01
-3.068185e-01	-1.913250e-01	6.335375e-02	3.487525e-01	-3.313475e-01	-3.469917e-01	2.821724e-01	-1.474714e-01	4.780640e-01	-1.169282e-01	-4.431629e-01	-6.000200e-01
4.751111e-01	1.262084e-02	-1.638248e-01	-8.682099e-02	1.643180e-01	-2.497904e-01	-1.849357e-01	-4.146455e-01	-4.630007e-01	6.976036e-04	-2.726556e-01	3.959203e-01
4.847667e-01	4.902806e-01	-9.200784e-02	-3.884129e-01	-3.053054e-01	-1.124456e-01	-4.915102e-02	-3.855508e-02	-7.142316e-01	-1.555290e-01	1.915907e-01	4.344622e-01
3.467337e-01	-6.084457e-01	6.162719e-02	2.841789e-01	6.275973e-01	2.148530e-01	-2.962044e-01	-2.918035e-02	-7.371193e-01	5.072587e-01	-2.822929e-01	-1.531991e-01
-1.959795e-01	-2.308958e-01	6.419477e-02	-5.056978e-02	2.543988e-01	-5.241727e-02	6.570294e-01	6.951016e-02	5.590041e-01	-3.582273e-01	-3.326224e-01	-3.895148e-02
4.920350e-01	1.495582e-01	-3.538401e-02	3.380933e-01	-2.208799e-02	-6.200792e-02	-2.263491e-01	2.550602e-01	1.850568e-01	-8.284675e-02	3.931175e-01	-4.182865e-01
-9.806275e-02	-5.277232e-02	-1.633180e-01	1.192621e-01	2.878210e-01	1.949759e-01	-9.769053e-02	-2.670781e-01	-3.128213e-01	-1.540638e-02	4.813694e-02	-5.325030e-01
-1.949494e-01	4.910172e-01	-2.502958e-01	2.588474e-02	-3.313701e-01	-1.911667e-01	-2.013744e-01	-1.185488e-01	-3.565041e-02	-3.884450e-01	-1.693748e-02	-1.038315e-02
7.693582e-02	2.403778e-01	3.085659e-01	6.734315e-02	1.037761e-01	-2.041006e-01	4.124604e-01	1.032827e-01	-6.490542e-02	-3.318205e-01	1.824989e-01	2.610047e-01
3.338648e-02	-9.530368e-02	-5.193932e-01	6.592563e-01	-3.459219e-01	4.497138e-01	-2.998323e-01	-6.402257e-01	6.831321e-01	1.832608e-01	4.776954e-01	6.488616e-02
-4.392649e-01	7.126846e-02	4.010280e-01	6.606444e-02	2.198492e-01	7.680587e-01	-1.039260e-01	-4.984837e-02	2.996561e-01	7.913937e-02	5.398920e-01	-2.744916e-01
-3.127235e-01	-3.575595e-01	5.557080e-01	6.213169e-01	-3.028163e-01	5.102366e-01	-6.096515e-02	7.537160e-02	5.694547e-02	-2.233950e-01	2.760396e-01	3.894331e-01
-1.610394e-01	1.735031e-01	-2.470737e-01	-2.250801e-01	-2.006407e-01	9.340706e-02	4.916839e-01	2.963395e-01	-2.234115e-01	4.908628e-01	-2.214612e-01	-3.095674e-01
-2.253840e-01	4.490652e-01	-3.025989e-01	-3.717393e-01	-3.344783e-01	4.269840e-01	4.303567e-01	4.178675e-01	-2.413049e-01	2.765776e-03	5.494927e-01	-1.860339e-01
-3.348572e-03	1.089360e-01	7.892962e-01	1.451188e-01	1.192601e-01	-8.705124e-02	4.367687e-01	-3.363511e-01	-2.055520e-01	1.361530e-01	-4.678160e-02	-3.360002e-01
2.713710e-01	2.453146e-01	-3.582925e-01	2.147152e-01	-2.623170e-01	7.770702e-01	4.313174e-01	-7.262094e-02	-5.328558e-01	-2.639149e-01	-7.912279e-02	-7.016425e-01
2.944233e-01	-7.225907e-02	-2.929634e-01	-1.588192e-01	-6.119867e-01	1.395556e-01	-3.267784e-01	-3.424564e-01	4.056102e-02	-6.178980e-01	-3.730871e-03	-1.688756e-01
3.109978e-01	-1.496342e-01	2.630197e-01	3.086983e-01	-4.649634e-01	2.708937e-01	1.591076e-01	1.167192e-01	1.679279e-01	-3.182894e-01	-3.178480e-01	1.881531e-02
-3.766223e-01	-3.549276e-01	-1.581030e-01	4.218027e-02	2.238953e-01	1.153349e-01	2.935668e-01	4.898262e-01	3.183748e-01	5.010725e-01	-6.035564e-02	-5.455701e-01
5.833293e-01	3.530753e-01	-1.168370e-01	-5.619134e-01	4.276567e-01	-9.830670e-02	-4.047313e-01	-2.900383e-01	6.654019e-01	-3.482323e-01	4.301098e-01	1.228099e+00
5.087927e-01	-5.207971e-01	6.439629e-01	-1.913060e-01	9.232467e-02	-3.853960e-01	-2.258007e-01	-1.865552e-01	6.546202e-01	5.272927e-02	1.094432e-01	3.366978e-01
5.224709e-01	-5.084698e-01	-2.506593e-02	-2.938778e-02	-2.364403e-01	1.017893e-01	2.437439e-01	-4.941366e-01	-3.557674e-02	2.128037e-01	-1.859568e-01	1.501292e-01
2.499823e-01	-1.331396e-01	-9.627739e-02	2.461664e-01	4.133919e-01	2.470512e-02	3.628211e-01	-1.308820e-01	-1.930609e-01	2.480360e-01	-3.704071e-02	2.469324e-01
1.227169e-01	1.763445e-01	1.022095e-02	3.413510e-02	-2.000347e-01	1.442529e-01	1.199005e-01	-4.217359e-01	7.735363e-02	1.428954e-01	-1.911688e-02	-4.365029e-01
9.560791e-02	-2.871523e-01	2.983463e-01	-6.746199e-02	5.857652e-02	-4.025386e-01	9.241872e-02	-5.871117e-02	3.489687e-01	-1.296031e-01	2.755407e-01	1.289121e-02
-9.584627e-01	-5.476910e-01	2.285792e-01	-2.798307e-03	1.007107e-02	2.676085e-01	6.385922e-01	-1.271969e-01	5.854232e-02	1.455035e-01	-8.135046e-01	-5.350905e-01
-2.560254e-01	6.430269e-01	1.292345e-01	-7.598704e-01	2.668960e-01	-3.360850e-01	2.768500e-03	-2.987543e-01	5.314191e-01	-2.191015e-01	4.188395e-02	-1.991084e-01
-1.042221e-01	2.726752e-01	-9.061091e-04	2.263791e-02	-1.164683e-01	-1.850937e-01	2.066910e-01	2.159652e-01	6.967700e-02	2.552165e-01	-7.157313e-01	5.044759e-01
-3.116859e-02	2.825525e-01	1.011413e-02	1.408441e-01	8.939561e-02	-3.515796e-01	4.502942e-02	5.131189e-01	3.024620e-01	-5.352160e-01	2.661342e-01	-3.336607e-01
1.703150e-01	1.814244e-02	7.140961e-01	-3.823968e-01	-2.809014e-01	1.725343e-01	8.494524e-02	3.448499e-01	1.187244e-01	1.929398e-02	1.259548e-01	2.996040e-01
-6.311427e-01	-9.540294e-02	-1.099152e-01	2.625802e-01	-3.050751e-01	-5.500780e-01	-5.323665e-01	3.239766e-01	-6.200181e-01	-9.945664e-02	-1.597655e-01	-2.037054e-01
-3.735641e-01	-3.713366e-01	-9.245238e-02	5.270341e-01	1.270510e-01	-7.420775e-01	1.004694e-01	3.738729e-01	-1.244722e-01	-1.825366e-01	1.280052e-01	-2.274937e-01
-4.521537e-01	2.460561e-01	-2.057325e-03	6.936060e-01	3.231373e-01	3.032118e-01	-8.689903e-02	2.373290e-01	-1.420249e-01	2.403039e-01	-1.507350e-01	3.454075e-01
-7.047696e-02	-2.808912e-02	-1.368086e-01	-2.606003e-01	1.899178e-01	-4.857893e-01	3.079709e-01	4.527581e-02	-2.405786e-01	4.266238e-01	6.562909e-02	-2.606337e-02
1.725129e-01	2.129316e-01	-4.203041e-01	-3.065416e-01	-3.737423e-01	2.876209e-01	5.812224e-01	3.227012e-01	1.146504e-01	-1.693030e-01	-6.092895e-01	-8.466532e-03
-9.290665e-02	2.959101e-01	-2.821760e-01	-3.269067e-01	1.002636e-01	-8.286114e-02	-2.676941e-01	-2.307458e-01	-6.103382e-01	-4.578504e-01	8.551680e-02	-2.160883e-01
4.046700e-01	8.305890e-02	2.175631e-01	-6.308727e-01	3.968441e-01	2.786479e-01	-4.271181e-02	3.510938e-01	-4.015974e-01	-1.172716e-01	-2.255165e-01	-1.065637e-01
4.780970e-01	-1.003428e-01	-2.421147e-01	-3.200853e-01	2.077872e-01	-7.594048e-02	9.222544e-02	3.283994e-01	6.880514e-02	2.278119e-02	-1.147205e-01	9.003656e-02
9.394629e-02	-9.061906e-02	4.804462e-02	-1.498169e-01	-1.279312e-01	-1.758227e-01	-2.250707e-01	-2.600563e-01	1.586354e-01	1.043324e-01	-2.782239e-01	3.884619e-01
-8.323374e-04	-7.777071e-03	3.392064e-01	-3.697823e-01	-3.157530e-01	-2.070774e-01	4.432471e-01	-1.150389e-01	4.430614e-01	1.575907e-01	-4.144217e-01	3.045566e-01
-3.836867e-01	9.975248e-02	-6.154922e-01	-1.276620e-01	-1.331947e-01	3.644754e-01	-5.131371e-02	-5.409805e-02	-3.053703e-01	5.902761e-01	7.203277e-01	1.351596e-03

Second MLP Layer Weight (MLP_Dim = 48)

1	2	3	4	5	6	7	8	9	10	11	12
3.647600e-02	2.320009e-02	-8.298698e-03	3.798847e-02	-1.708913e-01	1.392411e-02	2.147764e-01	-9.326314e-02	1.449290e-01	-2.219994e-02	1.933442e-01	-1.302793e-01

9. Residual Connection

$$x_{final} = \text{input_x2} + \text{h4}$$

(in this case, input_x2 is value before LayerNorm2. x_{final}=[4,12])

Output Layer

$$\boldsymbol{h_{last}} = \boldsymbol{x_{final}}[-\mathbf{1}]$$

$$\textbf{logits} = \boldsymbol{h_{last}} \cdot \boldsymbol{W_{out}^{T}} + \boldsymbol{b_{out}}$$

*In this case, logits has shape of [1, 300] (if you need 4 tokens, keep all $\boldsymbol{h_{last}}$

Output Layer Weight ($\boldsymbol{W_{out}}$=[300, 12])

1	2	3	4	5	6	7	8	9	10	11	12
-7.012981e-01	-1.534881e-02	3.749951e-01	6.869908e-02	2.214945e-01	8.481278e-02	-1.625734e-01	3.728701e-01	-6.124342e-01	5.233702e-02	-2.821224e-02	-3.558294e-01
5.747641e-01	-1.283839e-02	7.790766e-01	2.710546e-01	3.476255e-01	-4.909758e-01	-2.627245e-01	7.810609e-01	-5.572628e-01	-4.511980e-01	-2.059188e-01	1.297116e-02
-7.000353e-01	-1.606948e-02	3.742004e-01	6.764980e-02	2.222537e-01	8.457713e-02	-1.621842e-01	3.719840e-01	-6.114433e-01	5.054276e-02	-2.905967e-02	-3.546697e-01
-7.691151e-02	3.564835e-01	7.681263e-01	8.244079e-01	1.806321e-01	1.546510e-01	-6.287482e-02	1.376739e-01	-8.978835e-01	-9.053059e-01	4.105914e-01	9.150273e-01
6.375547e-02	2.058683e-01	-2.818737e-01	-1.940697e-01	-4.425125e-01	-4.207795e-01	4.967715e-01	-3.647259e-02	-3.831129e-01	2.439543e-01	-4.852616e-01	-5.757291e-01
2.246160e-01	-9.037864e-02	1.475167e-01	-2.453872e-01	-9.823159e-02	-5.208553e-01	-2.466254e-01	-1.107216e+00	7.473120e-03	4.328158e-01	-1.959456e-02	-1.553835e-02
2.941775e-01	3.583975e-01	-4.338071e-01	2.452606e-02	-4.062870e-01	5.602590e-01	-1.812271e-01	-6.758379e-01	-2.132618e-01	2.661316e-01	-5.010597e-01	3.082531e-01
4.863762e-01	2.155438e-01	6.794329e-01	-1.077169e-01	-1.320064e-01	-4.036469e-01	-9.464066e-02	4.580882e-01	3.483165e-01	6.968014e-02	2.007455e-01	2.875810e-01
2.032448e-01	4.525948e-01	1.755809e-01	-6.609076e-02	-7.480044e-01	8.781306e-02	-3.205666e-01	-4.011980e-01	-3.835826e-01	-1.102135e-01	-5.450822e-01	5.414720e-01
1.800572e-01	-6.858487e-02	2.240251e-01	-2.040183e-01	-2.258659e-01	-4.687809e-01	-7.088593e-01	-6.956212e-01	4.577834e-02	1.215202e-01	-1.690491e-01	5.446649e-01
3.582377e-01	1.941983e-01	6.861368e-01	-1.582965e-01	-4.325330e-02	4.395774e-02	-2.608127e-01	3.878188e-01	2.548632e-01	-4.434481e-01	3.023050e-01	5.732037e-01
1.119262e-02	1.420789e-01	2.853532e-01	-3.825569e-01	-2.024527e-01	3.444151e-01	4.055303e-01	4.625521e-01	2.265968e-01	-5.193948e-01	2.306034e-01	4.692274e-01
4.328303e-01	3.359342e-02	1.319500e-02	-3.228879e-01	1.933933e-01	-4.733142e-01	-2.576093e-01	-1.107972e-01	6.193715e-01	5.286608e-01	7.138918e-02	-1.376688e-01
5.236815e-01	1.549037e-01	-1.612758e-01	-7.403072e-02	2.395601e-01	-1.427385e-02	5.785968e-01	1.704287e-01	1.360354e-01	-6.435586e-01	-2.910423e-01	-4.419883e-01
-6.909894e-01	-3.423115e-01	2.557515e-01	-2.415295e-01	-5.452796e-01	1.189954e-02	2.003596e-02	-3.962016e-02	4.245621e-02	-4.862174e-01	4.394194e-01	2.483280e-01
3.303732e-01	4.524538e-01	-4.134766e-01	-5.724636e-02	1.775235e-01	6.082065e-02	2.057210e-01	-3.233865e-01	-1.984698e-01	2.767485e-01	-4.618651e-01	-4.700254e-01
-1.059577e-01	1.960026e-01	-4.298541e-01	-2.617688e-01	-1.601622e-02	-2.178185e-01	5.991670e-01	2.202472e-02	-3.510796e-01	-3.398077e-01	-5.980545e-01	-5.933843e-01
-7.549241e-01	1.935679e-01	-7.567414e-02	-2.390226e-01	2.548902e-01	-5.244452e-01	4.757861e-01	6.853558e-01	2.763959e-01	1.720261e-01	4.082734e-02	-3.335191e-01
-4.667164e-01	-2.189571e-01	-1.712346e-02	4.339891e-01	4.837156e-01	-2.240702e-01	4.881597e-01	6.659451e-01	2.370680e-01	-1.183140e-01	1.921059e-01	-2.004119e-01
-1.227853e-01	3.539467e-01	4.421140e-02	-1.794862e-01	-7.248461e-02	3.955189e-01	4.440015e-01	5.009142e-01	4.289640e-01	2.151972e-01	-5.740832e-02	5.461831e-01
4.055106e-01	4.891977e-04	6.454903e-01	-4.631345e-01	-4.148870e-02	-5.924683e-01	-4.410275e-01	-3.697713e-01	1.893042e-02	-4.642654e-01	4.348386e-01	3.093281e-01
-3.466196e-01	-2.724262e-01	1.511395e-01	5.457464e-01	-1.464042e-02	-5.453664e-01	4.279306e-01	2.468832e-01	8.542333e-02	2.715232e-01	3.783229e-01	-5.075352e-01
-2.855732e-01	-4.549870e-01	-5.336958e-01	2.315951e-01	-1.010827e-01	3.912259e-02	5.484520e-01	1.647787e-01	-3.854800e-01	-1.741846e-01	-1.499654e-01	-3.120022e-01
-2.743295e-01	-2.145071e-01	-1.505233e-01	-1.810011e-01	2.378264e-01	1.042492e-02	-8.006944e-01	-4.862231e-01	3.415391e-01	-1.307670e-01	-2.125603e-01	-2.415783e-01
-3.401875e-01	-4.433690e-01	-2.454286e-01	-2.557311e-01	-5.049043e-01	-1.181694e-01	2.489267e-01	1.345481e-01	-3.136804e-01	-3.101598e-02	-2.374886e-01	-7.320890e-01
-5.412158e-01	-3.657579e-01	-2.985385e-01	4.236853e-01	6.105911e-01	5.341933e-01	-5.355069e-02	-8.097178e-02	1.742701e-01	-4.077742e-01	1.290901e-01	1.241816e-01
-2.746863e-01	1.894327e-01	-3.194716e-01	4.947165e-01	4.625401e-01	5.672216e-01	-6.502573e-01	-5.271959e-01	1.744584e-01	-2.614751e-01	-2.628234e-02	3.915015e-01
-9.725554e-02	-4.124799e-01	2.641608e-01	-3.077648e-01	-2.257501e-01	-7.604089e-01	-3.599552e-01	-3.081810e-01	1.707435e-01	3.516077e-01	2.847871e-01	-2.158883e-01
6.667510e-02	4.568036e-01	2.762268e-01	-3.291722e-01	-4.280719e-01	1.520441e-01	-5.391631e-02	3.111611e-01	2.999936e-01	-1.882169e-02	-7.378413e-02	8.273808e-01
5.164238e-01	2.432210e-01	-4.860764e-01	4.014769e-03	1.394829e-01	-2.166236e-01	5.741993e-01	-8.581949e-02	-4.824068e-01	3.058310e-01	-1.854322e-01	-2.688933e-01
-4.686604e-02	-2.413551e-01	3.320780e-01	-8.057579e-02	-8.672078e-02	-9.531573e-02	-6.699141e-01	2.882923e-01	4.438641e-01	-1.817044e-01	3.744540e-01	5.832649e-01
1.954397e-01	5.130653e-01	-9.871875e-02	-5.395941e-02	-9.196277e-02	4.343772e-01	-1.686043e-01	1.236026e-01	3.164541e-01	1.219084e-01	-4.723136e-01	4.644797e-01
-4.267975e-01	-1.511404e-01	9.003444e-02	-2.155570e-01	-3.744056e-01	-3.469948e-01	-5.431327e-01	-2.959816e-02	4.540067e-01	4.515442e-01	-1.544659e-01	5.038757e-01
-3.715432e-01	8.539304e-02	5.557193e-01	-1.640064e-01	-6.074492e-01	-2.635419e-01	-1.848215e-01	2.277717e-01	1.606286e-01	-3.703280e-03	3.501329e-01	7.140831e-01
-1.513990e-01	-3.360266e-01	-5.585725e-01	6.084349e-03	-1.750918e-01	-1.910645e-01	4.691420e-01	-3.070856e-01	-5.085495e-01	5.025151e-01	-1.934657e-01	-8.325408e-02
-7.895127e-02	1.508184e-01	2.979277e-01	-4.681897e-01	-5.550995e-01	1.152035e-01	-1.494814e-01	2.132228e-01	-2.366493e-01	-6.340355e-01	-8.814029e-02	2.545816e-01
-1.075839e-01	2.371007e-02	1.636934e-01	4.663921e-01	6.520713e-01	2.513200e-01	1.107331e-01	5.969954e-01	3.462865e-01	-3.295852e-01	2.694739e-01	-2.017032e-01
-3.818699e-01	1.762557e-01	-1.457654e-01	-2.983706e-01	-5.896470e-01	2.451967e-01	1.586437e-01	-1.004597e-01	2.293242e-01	3.745109e-01	-4.105900e-01	3.179317e-01
-2.601763e-01	-5.614288e-01	-1.262026e-01	-1.620055e-01	2.248808e-01	-4.922877e-01	-3.145939e-01	-7.248789e-01	3.082351e-02	3.337423e-01	-3.079800e-02	-4.606810e-01
-3.768940e-01	-2.692933e-01	4.504033e-01	-2.681773e-01	-4.891065e-01	-5.824328e-01	-4.577754e-01	-1.462470e-01	-1.198555e-01	-4.233690e-01	2.079424e-01	-8.669486e-02
5.241315e-01	-4.500533e-01	-2.932575e-01	9.100246e-02	-5.405188e-02	2.313344e-01	-4.788309e-02	-4.393213e-01	-5.968281e-01	-3.259974e-01	2.166591e-01	-4.719009e-01
2.971513e-01	2.246447e-01	-7.183499e-02	1.788650e-01	-3.197771e-01	-3.194399e-01	7.235251e-01	3.054863e-01	-1.086003e-01	-1.360794e-01	-1.202569e-01	-4.532169e-01
6.927944e-01	3.476361e-01	-2.050105e-01	-8.281721e-02	9.748215e-02	-1.738124e-01	1.541649e-01	-4.898526e-01	-3.850002e-01	-2.011264e-01	3.332933e-02	-7.266485e-01
-6.108799e-01	-2.863135e-01	1.212578e-01	-3.942263e-01	-2.673718e-01	-4.599023e-02	-5.806515e-01	-5.418610e-01	-1.509868e-01	-8.324642e-01	1.397309e-01	-1.690012e-01
-6.477975e-02	2.210411e-01	-5.378792e-01	4.132904e-01	6.416039e-01	1.381000e-01	-3.110975e-01	-6.740617e-01	1.038344e-01	2.130557e-01	-1.538518e-01	-2.979245e-01

4.456567e-01	-1.223012e-01	2.752060e-01	-5.623786e-01	3.390596e-01	-1.215289e-01	2.792983e-01	-2.109635e-01	3.592532e-01	7.067341e-01	-3.864557e-01	-2.991668e-01
-5.331873e-01	1.262731e-01	-2.702526e-01	3.117711e-01	1.804105e-01	-1.290877e-01	7.618653e-01	3.356434e-01	-1.220332e-01	1.795076e-01	-3.426597e-01	4.350983e-01
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-6.440459e-02	-1.413748e-01	3.821807e-01	-2.860893e-01	6.287783e-01	3.188772e-01	-1.340346e-01	-3.904669e-01	-4.485946e-01	2.059337e-01	-3.227309e-01	2.672389e-01
-3.234040e-01	-7.538027e-02	3.760491e-01	-3.297514e-01	6.278787e-01	2.256039e-01	2.616164e-01	-1.601070e-01	-4.399673e-01	6.021263e-02	-4.522793e-01	2.210108e-01
-9.599178e-03	8.092006e-02	6.023921e-01	-3.999971e-01	5.279318e-01	3.003182e-01	1.761356e-01	1.473715e-01	-1.640823e-01	-1.181556e-01	-4.092340e-01	2.279363e-01
-4.772364e-01	-1.447575e-01	-3.809597e-01	2.096809e-01	5.629574e-01	2.857996e-01	-3.634940e-01	3.234265e-01	3.635583e-01	9.060378e-03	2.645303e-01	-1.158467e-01
5.857022e-02	-5.474910e-02	-2.782157e-01	4.817305e-01	7.894015e-01	-2.070993e-01	2.387859e-01	-3.035171e-01	-4.001247e-01	1.617120e-01	1.516796e-01	-2.078943e-01
-3.835204e-01	1.678890e-01	2.051277e-01	-2.009509e-01	5.572851e-01	1.339021e-01	-1.908535e-01	7.948463e-01	2.248035e-02	-2.084577e-01	-1.439855e-02	2.218509e-01
-7.883090e-01	-3.739692e-01	-1.504513e-01	-5.555227e-02	3.946035e-01	1.061481e-01	4.121031e-02	9.459268e-02	-2.128707e-01	7.832510e-03	-3.676014e-02	-1.781881e-01
-1.645316e-01	-4.395887e-01	6.369650e-01	-2.326524e-01	-5.675975e-02	-8.279357e-01	-1.746097e-01	-1.593307e-01	-1.802557e-01	4.575218e-01	-5.581927e-01	-5.245048e-01
-1.668178e-01	-7.074085e-01	1.447532e-01	4.330518e-01	4.447982e-01	1.459783e-01	1.025829e-01	-2.123495e-01	-5.884358e-01	-5.498333e-01	-5.542061e-02	-2.597900e-01
-3.550547e-01	-9.717638e-02	6.398174e-01	3.573947e-02	3.022959e-01	2.664548e-01	9.074777e-02	4.635019e-01	-2.768514e-02	-3.343628e-01	-4.460742e-01	-1.942942e-01
2.216273e-01	4.434219e-02	7.381237e-01	7.131148e-02	4.297073e-01	3.261477e-01	-2.278876e-01	2.792663e-01	-3.610021e-01	-3.867026e-01	-2.612419e-01	2.206918e-01
1.540252e-01	-9.572404e-03	7.250658e-01	2.967392e-01	5.563549e-01	2.224988e-01	2.142649e-01	5.196905e-01	-1.367502e-01	-3.349116e-01	-2.354581e-01	-1.975307e-01
-6.060443e-02	-8.267936e-01	3.125984e-01	-7.875821e-02	3.406548e-01	1.676472e-01	-3.586636e-01	-1.750606e-01	-8.458237e-01	1.032407e-01	-2.653333e-01	-2.930214e-01
-7.823076e-01	-5.979748e-01	-3.966425e-02	3.734010e-01	5.378022e-01	-2.739295e-01	3.187715e-01	1.513423e-01	-3.886468e-01	-1.136711e-01	-1.557109e-01	-1.804512e-01
-7.113910e-01	-4.131953e-01	5.148436e-01	-1.016524e-01	-1.575616e-01	1.256337e-01	1.444226e-01	2.589256e-01	-5.167560e-01	-3.693629e-01	-4.865914e-01	-2.833372e-01
-5.260523e-01	-2.588758e-01	4.714725e-01	2.198477e-01	4.225246e-01	3.358539e-01	2.547836e-01	3.919939e-01	-4.386269e-02	-2.339309e-01	-4.148364e-01	-1.950931e-01
-3.159560e-01	-4.413661e-02	2.242743e-01	5.826489e-02	5.343807e-01	3.371488e-01	-4.051743e-01	5.350824e-02	1.013978e-01	-5.214702e-01	4.674041e-02	-1.964328e-01
2.771134e-01	-6.413653e-01	6.050456e-01	2.059053e-01	-2.402142e-02	1.130681e-01	-4.119713e-01	2.136530e-01	-6.100997e-01	-2.925247e-01	-1.459803e-01	-4.223858e-01

-7.706261e-01	-3.426419e-01	4.413107e-01	-1.395518e-01	2.881173e-01	2.962736e-01	-3.309541e-01	6.452674e-02	-2.325010e-01	-2.647622e-01	-3.927692e-01	-1.589403e-01
-4.531375e-01	-3.366653e-01	4.732955e-01	-2.358461e-01	2.985690e-01	2.536418e-01	-2.455834e-01	3.167972e-01	-4.604683e-01	-4.733773e-01	-4.013008e-01	-1.779151e-01
-4.336995e-01	-1.965338e-01	5.328446e-01	-7.966431e-02	3.503082e-01	2.809504e-01	-3.487691e-01	4.507131e-01	-1.413873e-01	-3.029085e-01	-4.509254e-01	-2.138900e-02
-5.776948e-01	-2.927523e-02	5.428417e-01	-5.997303e-02	2.796442e-01	2.146986e-01	-2.614280e-01	4.678572e-01	-2.598878e-02	-9.973990e-02	-4.829116e-01	-2.458683e-01
-5.826425e-01	-5.250519e-01	1.402856e-01	4.628528e-02	5.061423e-01	3.377785e-02	-1.648275e-01	-4.929553e-02	-5.907162e-01	4.180099e-01	-4.432134e-01	-2.059047e-01
-4.942750e-01	-4.684952e-02	5.133657e-01	1.329600e-01	3.975275e-01	3.104959e-01	2.240212e-01	5.618958e-01	-1.454026e-01	-5.287844e-02	-4.638450e-01	-1.833441e-01
-2.930788e-01	-1.051969e-01	4.375615e-01	3.633689e-01	5.744742e-01	2.297805e-01	3.427715e-01	2.804537e-01	-2.382085e-01	-4.147364e-01	-2.637431e-01	-3.241757e-01
1.695275e-01	-1.169845e-01	3.062500e-01	-9.065144e-02	-8.541207e-02	-1.646103e-01	-2.087596e-01	-5.742273e-02	1.365981e-01	3.512342e-01	2.298089e-02	-3.178463e-01
-4.445782e-02	1.922020e-01	5.832497e-01	-4.276887e-02	-3.700502e-02	3.259747e-01	-2.409173e-01	4.108668e-01	6.867246e-02	-1.406345e-01	-3.682519e-02	4.305610e-01
-1.942122e-01	-3.823451e-01	3.143716e-01	2.072088e-01	2.620291e-01	-1.402605e-01	-3.293250e-01	4.772456e-01	-9.818434e-02	-3.817738e-01	3.007326e-01	-3.765539e-01
-4.070430e-01	-1.047595e-01	4.244281e-01	-5.011898e-02	1.204166e-01	1.610903e-01	-8.028563e-02	5.148040e-02	-3.411996e-01	-2.713428e-01	-5.883548e-01	-3.654879e-01
-5.862983e-01	-1.750753e-01	3.751129e-01	-1.902485e-01	4.230833e-01	2.186926e-01	-1.809500e-01	3.289036e-01	-2.888194e-01	-3.461519e-01	-3.999906e-01	-2.153640e-01
-7.019061e-01	-2.536966e-01	2.817383e-01	-1.053250e-02	4.462650e-01	1.685090e-01	1.335222e-01	3.162641e-01	-4.432721e-01	-3.520202e-01	-3.040058e-01	-1.779318e-01
-2.698220e-02	-1.457990e-02	-7.592254e-02	-6.009977e-03	-8.269783e-02	-1.120277e-01	-2.270082e-01	1.787355e-01	-1.011193e-01	2.360591e-01	-3.485929e-01	-3.340365e-01
-6.840807e-01	-4.145209e-01	2.881118e-01	1.892412e-01	4.247157e-01	1.067291e-01	1.133254e-01	4.204974e-01	-1.693071e-01	-2.477670e-01	-2.145402e-01	-3.572562e-01
8.538638e-02	2.901128e-01	6.214806e-01	1.076991e-01	4.347050e-01	9.876048e-02	-2.817720e-01	4.650835e-01	-5.066568e-01	1.362680e-01	-3.651535e-01	-1.203260e-01
-2.969579e-01	-2.674543e-01	-6.828578e-02	-6.897876e-02	3.510098e-01	1.634886e-01	7.987593e-02	5.165491e-01	1.391499e-01	-3.266697e-02	-2.528659e-01	-1.522495e-01
-4.878820e-01	-1.064465e-01	2.412809e-01	-7.971299e-02	3.796884e-01	1.321534e-01	-2.045757e-01	3.152354e-01	-1.541088e-01	-1.119958e-01	-1.202506e-01	-2.460062e-02
-3.196955e-01	-4.289355e-02	3.010070e-01	-9.126277e-02	3.878591e-01	-2.673780e-02	1.536889e-02	2.454010e-01	-1.619146e-01	-1.369955e-01	-2.312706e-01	-2.073101e-01

Output Layer Bias (b_{out}=[25,12])

1	2	3	4	5	6	7	8	9	10	11	12
-6.634552e+00	6.170157e-01	-6.652421e+00	-2.061713e+00	-2.618940e-01	-9.812099e-01	-4.086130e-01	2.244326e-01	-1.604753e-02	-1.650872e-01	3.644174e-01	1.281040e+00
-3.348395e-01	3.984979e-01	5.732086e-01	2.346973e-01	4.229756e-01	5.645238e-01	1.288048e+00	7.176578e-01	-5.842587e-01	-9.027578e-02	3.294218e-01	7.591552e-01
7.350406e-01	5.201762e-01	5.522144e-02	-6.799488e-01	3.278614e-01	1.995024e-01	2.804384e-02	8.363327e-01	-2.651612e-01	-5.968131e-02	1.748500e-01	5.121496e-01
7.254930e-01	-1.940286e-01	-1.007436e-01	-8.137538e-02	7.344745e-01	-2.029971e-01	3.190012e-01	-3.805647e-01	2.356556e-01	1.223961e+00	-4.116027e-01	6.232842e-01
1.515677e-01	-5.519732e-01	2.323481e-01	3.491233e-01	-4.297716e-01	8.013657e-02	-1.870994e-01	-1.938767e-01	-2.161007e-01	-2.870471e-01	-2.489797e-01	-1.498195e-02
4.191538e-02	4.852690e-01	1.362205e-01	2.425593e-03	-1.212436e+00	-7.682367e-02	3.267876e-01	1.153915e-01	2.531457e-01	2.712769e-01	-5.576001e-01	-3.059282e-01
1.504552e-01	-9.292938e-01	-3.395756e-01	3.848313e-01	-5.840351e-02	7.237568e-01	6.706707e-01	-8.526660e-01	1.942796e-01	1.471369e-01	2.065965e-01	-2.156182e-01
4.419324e-01	-6.669522e+00	6.506515e-01	-7.080079e-02	2.516094e-01	4.616310e-01	-2.852116e-01	-2.317584e-01	6.433147e-01	5.152933e-02	-2.729456e-01	-2.284579e-01
-1.001484e+00	-3.011953e-01	-4.050147e-01	4.069330e-02	-4.604845e-01	5.794752e-01	-2.953122e-01	1.812937e-01	-5.359137e-01	-5.210617e-01	-9.048456e-01	-1.808623e+00
7.753787e-01	-7.041377e-01	3.785975e-01	1.691801e-01	-3.763646e-01	-1.057818e-02	-5.064652e-01	-3.206836e-01	-9.285566e-01	2.203624e-01	-6.486045e-01	3.793363e-01
-7.123774e-01	2.220378e-01	3.181592e-01	-7.812145e-02	-5.709406e-01	-1.573624e-01	-4.984484e-01	2.815996e-02	-6.509402e-02	-3.364364e-01	-8.824155e-01	-4.284362e-02
-7.043603e-01	-7.395552e-01	1.228538e-01	-6.967743e-01	8.308882e-03	2.390303e-01	-2.494228e-01	-5.407260e-01	-3.086866e-01	-7.927525e-01	7.516963e-01	-1.907963e-01
-5.205950e-01	-3.470486e-01	-2.901392e-01	-2.198520e-02	1.959537e-01	-7.598581e-01	4.007582e-01	-8.535799e-01	-4.466481e-01	-1.101548e-01	-4.685671e-01	-5.979004e-01
-4.026540e-03	-7.631497e-01	-4.699306e-01	-8.578670e-01	-8.053812e-02	6.843362e-02	-7.536829e-02	-1.355171e+00	-3.222896e-01	-3.221138e-01	-9.717227e-01	-6.495908e-01
-2.427230e-02	-4.718605e-01	-5.657589e-01	-3.547646e-01	-1.255663e-01	-7.103180e-01	-4.068964e-01	2.851010e-02	-5.291488e-01	-2.707802e-01	-1.231791e+00	-3.484359e-01
-1.620721e-01	-2.557324e-01	-3.777580e-01	-4.875548e-01	-5.987243e-01	-5.977625e-01	-2.507184e-01	-1.546408e+00	-9.076051e-01	-8.210282e-01	-2.155222e-01	-8.418477e-03
-2.443368e-01	-5.114459e-01	7.932869e-02	-6.177450e-01	1.888654e-01	-7.219968e-01	-1.573663e-01	-5.368091e-01	-6.038482e-01	-5.591719e-01	-3.409569e-01	1.124179e-01
1.241688e+00	-4.871779e-01	8.720687e-01	2.752028e-01	-3.140719e-01	8.705854e-01	6.174989e-01	2.374939e-01	-8.679842e-01	-4.773482e-01	-9.438970e-01	-9.291019e-01
1.870508e-01	1.253110e+00	4.761325e-01	2.542902e-01	-1.866368e+00	3.568156e-01	-7.835507e-01	1.323103e+00	-2.621019e-01	-1.434869e+00	6.420482e-01	-1.906960e-02
2.694338e-01	-1.572783e+00	-8.111336e-01	-2.235330e-01	6.322753e-02	-8.965231e-02	9.027214e-02	-6.649862e+00	-6.655046e+00	-1.582260e-01	-2.064944e-01	-1.989877e-01
4.142733e-02	-3.298040e-01	-1.217898e-01	-2.286313e+00	-3.094601e-01	-5.606790e-01	-4.817659e-01	1.694102e-01	-1.650945e-01	-2.875136e-01	-1.893099e-01	-6.114040e-01
-7.815899e-01	-5.040283e-01	-6.623353e+00	-6.651492e+00	-4.910293e-01	2.097927e-01	2.330415e-01	-3.063605e-01	-1.381634e+00	-3.614333e-01	-3.656227e-01	3.501629e-01
3.097835e-02	-6.611194e-02	5.015392e-02	1.586669e-01	-6.950897e-01	-9.305867e-01	-9.290990e-01	-2.793964e-01	-2.807159e-01	-6.123894e-01	-2.086361e-01	-4.466833e-01
-9.102922e-01	-4.136308e-01	-6.826615e-01	-7.439186e-01	-5.644350e-01	-9.231557e-01	-1.020903e+00	-7.249500e-01	-7.534400e-01	-4.553648e-01	-4.105859e-01	-8.478576e-01
-6.373712e-01	-5.124789e-01	-1.035026e+00	-8.139002e-01	-1.134562e+00	-1.404207e+00	-8.742224e-01	-1.091110e+00	-8.025752e-01	-1.134119e+00	-1.075411e+00	-1.125656e+00

Softmax

$$\boldsymbol{prob_i} = \mathrm{softmax}(\mathrm{z})_i = \frac{\boldsymbol{exp}(\boldsymbol{z_i})}{\sum_j \boldsymbol{exp}(\boldsymbol{z_j})}$$

300 different probability will be calculated, and select the highest probability.
Then, select the token from the first tokenizer table.