

Lecture No.2.1: CUDA Debugging

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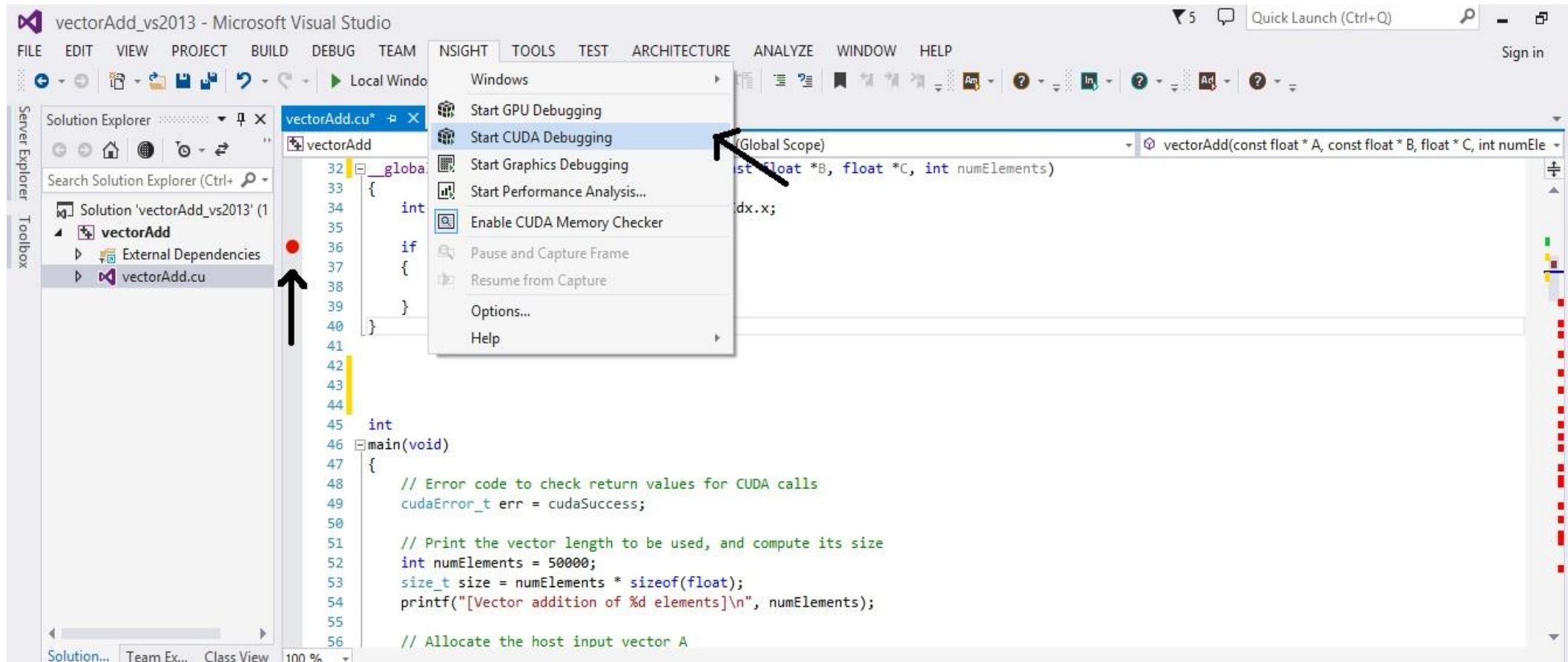
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NSIGHT for Visual Studio

- Extends the debugging and performance analysis capabilities of visual studio to support GPU applications
- CUDA debugger enables the debugging of CUDA kernels by setting breaking points in the kernel source code
- Performs memory checks using the “CUDA memory checker” option
- Can view the memory locations and their contents in any format
- Shows the values of local variables

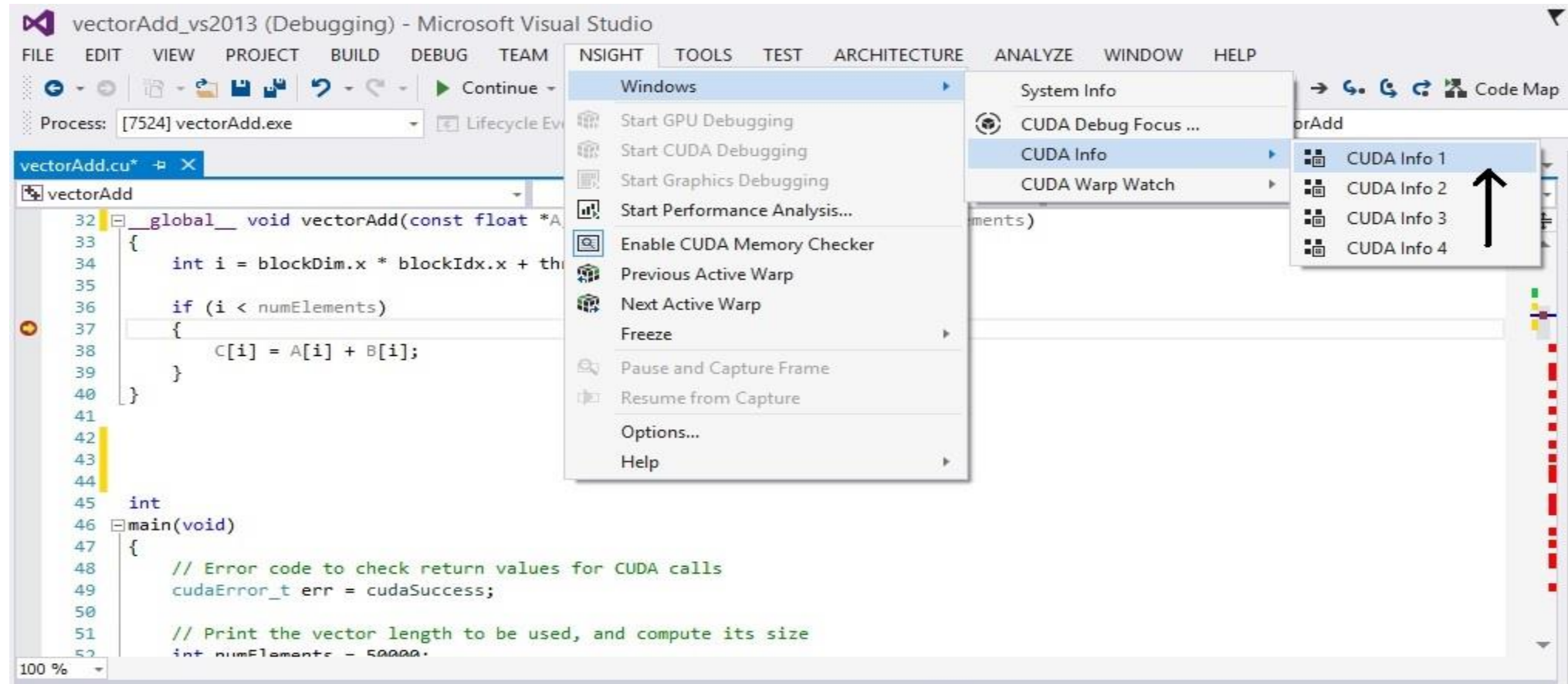
Case Study: Vector Addition

- Step 1: set a breakpoint in your kernel then launch the CUDA debugger



Vector Addition – Debugging Mode

- Step 1: show the CUDA Info 1 window to view memory allocations, warps, blocks, grids, etc.



Vector Addition – Local variables and CUDA Info

- To view memory locations of vector A, get its address from the locals window then find the matching CUcontext value in CUDA info 1 and select “Set Memory View Expression”

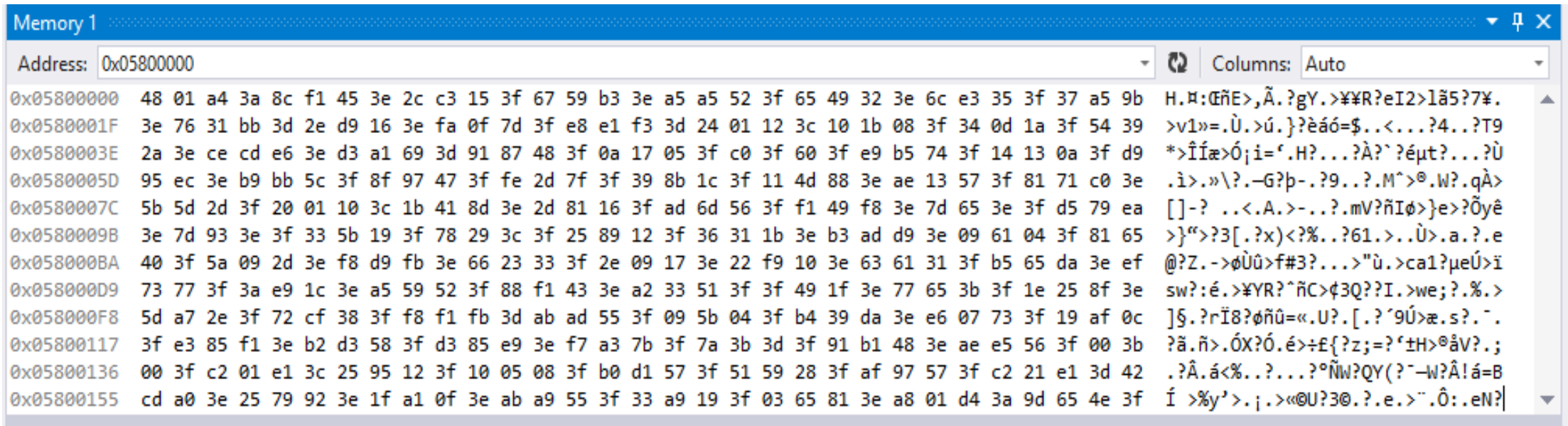
The image shows two windows from a debugger. The 'Locals' window on the left lists variables and their values. The variable 'A' is highlighted with a green circle around its value '0x05800000'. The 'CUDA Info 1' window on the right shows a table of memory allocations. The row for CUcontext '0x028467a8' with address '0x05800000' is highlighted and circled in green, matching the value in the 'Locals' window.

Name	Value	Type
@flatBlockIdx	0	long
@flatThreadIdx	96	long
threadIdx	{x = 96, y = 0, z = 0}	const uint3
blockIdx	{x = 0, y = 0, z = 0}	const uint3
blockDim	{x = 256, y = 1, z = 1}	const dim3
gridDim	{x = 196, y = 1, z = 1}	const dim3
@gridId	1	const long long
i	96	int
A	0x05800000 0.0012512589	_device__ const float* __para
B	0x05830e00 0.56358534	_device__ const float* __para
C	0x05861c00 -7.513833e+09	_device__ float* __parameter
numElements	50000	_parameter__ int

CUcontext	Type	Address	Size	End Address	Host Ptr	Name	Portable	Device M
0x028467a8	Device	0x05200000	4	0x05200004				
0x028467a8	Device	0x05200100	4	0x05200104				
0x028467a8	Device	0x05200200	8	0x05200208				
0x028467a8	Device	0x05200300	73	0x05200349				
0x028467a8	Device	0x05200400	69	0x05200445				
0x028467a8	Device	0x05800000	200000	0x05830d40				✓
0x028467a8	Device	0x05830e00	200000	0x05861b40				✓
0x028467a8	Device	0x05861c00	200000	0x05892940				✓

Vector Addition – Memory View (Integer)

- A new window will appear showing the memory addresses starting from the location of vector A and the stored value in each address



Address	Hex Value	ASCII
0x05800000	48 01 a4 3a 8c f1 45 3e 2c c3 15 3f 67 59 b3 3e a5 a5 52 3f 65 49 32 3e 6c e3 35 3f 37 a5 9b	H. 4: 0ñE>, Ä. ?gY. >¥¥R?eI2>lã5?7¥.
0x0580001F	3e 76 31 bb 3d 2e d9 16 3e fa 0f 7d 3f e8 e1 f3 3d 24 01 12 3c 10 1b 08 3f 34 0d 1a 3f 54 39	>v1»=. Û. >ú. }?èáó=\$..<...?4...?T9
0x0580003E	2a 3e ce cd e6 3e d3 a1 69 3d 91 87 48 3f 0a 17 05 3f c0 3f 60 3f e9 b5 74 3f 14 13 0a 3f d9	*>ÎÍæ>Ó;i='.H?...?À?'?éµt?...?Ù
0x0580005D	95 ec 3e b9 bb 5c 3f 8f 97 47 3f fe 2d 7f 3f 39 8b 1c 3f 11 4d 88 3e ae 13 57 3f 81 71 c0 3e	.i>.»\?.-G?p-.?9...?M^>®.W?.qÀ>
0x0580007C	5b 5d 2d 3f 20 01 10 3c 1b 41 8d 3e 2d 81 16 3f ad 6d 56 3f f1 49 f8 3e 7d 65 3e 3f d5 79 ea	[]-? ..<.A.>-...?mV?ñIø>}e>?Öyê
0x0580009B	3e 7d 93 3e 3f 33 5b 19 3f 78 29 3c 3f 25 89 12 3f 36 31 1b 3e b3 ad d9 3e 09 61 04 3f 81 65	>}“>?3[. ?x)<?%...?61.>..Û>.a.?.e
0x058000BA	40 3f 5a 09 2d 3e f8 d9 fb 3e 66 23 33 3f 2e 09 17 3e 22 f9 10 3e 63 61 31 3f b5 65 da 3e ef	@?Z.->øÛû>f#3?...>"û.>ca1?µeÛ>ï
0x058000D9	73 77 3f 3a e9 1c 3e a5 59 52 3f 88 f1 43 3e a2 33 51 3f 3f 49 1f 3e 77 65 3b 3f 1e 25 8f 3e	sw?:é.>¥YR?^ñC>¢3Q?I.>we;?%.>
0x058000F8	5d a7 2e 3f 72 cf 38 3f f8 f1 fb 3d ab ad 55 3f 09 5b 04 3f b4 39 da 3e e6 07 73 3f 19 af 0c]§. ?rİ8?øñû=«.U?.[. ?'9Ú>æ.s?.-.
0x05800117	3f e3 85 f1 3e b2 d3 58 3f d3 85 e9 3e f7 a3 7b 3f 7a 3b 3d 3f 91 b1 48 3e ae e5 56 3f 00 3b	?ä.ñ>.ÓX?Ó.é>÷£{ ?z;=?'±H>®âV?.;
0x05800136	00 3f c2 01 e1 3c 25 95 12 3f 10 05 08 3f b0 d1 57 3f 51 59 28 3f af 97 57 3f c2 21 e1 3d 42	.?Â.á<%...?...?°ÑW?QY(?^-W?Â!á=B
0x05800155	cd a0 3e 25 79 92 3e 1f a1 0f 3e ab a9 55 3f 33 a9 19 3f 03 65 81 3e a8 01 d4 3a 9d 65 4e 3f	Í >%y'>..>«@U?30.?.e.>".Ô: .eN?

- Note that all values are in 1-byte integer hexadecimal format
- To show the proper format, right click and select “32-bit floating point”

Vector Addition – Memory View

(Floating Point)

- The first 24 values of vector A

Memory 1							
Address: 0x05800000				Columns: Auto			
0x05800000	0.00125125889	0.193304241	0.585009336	0.350291461	0.822840035	0.174108103	H.¤:€ñE>,Ã.¿gY.>¥¥R?eI2>
0x05800018	0.710501432	0.303994864	0.0914029330	0.147312850	0.988525033	0.119083226	lã5?7¥.>v1»=.Û.ú.}?èáó=
0x05800030	0.00891140476	0.531662941	0.601763964	0.166234314	0.450788915	0.0570390932	\$..<...?4..?T9*>Îíæ>Ó;i=
0x05800048	0.783318579	0.519882798	0.875972748	0.955900729	0.539353609	0.462080747	‘.H?...?À`¿éµt?...?Û.ì>

- The first 24 values of vector B

Memory 1							
Address: 0x05830e00				Columns: Auto			
0x05830E00	0.563585341	0.808740497	0.479873031	0.895962417	0.746604800	0.858943462	!G.¿ž.O?ë±ð>Ë]e?~!??,ã[?
0x05830E18	0.513534963	0.0149845881	0.364452034	0.165898621	0.445692301	0.00466933195	.w.¿ë.u<u™>Tá)>È1ä>2.™;
0x05830E30	0.377880186	0.571184397	0.607165754	0.663045108	0.352122575	0.607684553	fyÁ>\$9.¿7o.¿S.)?iI'>7'.?
0x05830E48	0.802606285	0.301950127	0.726676226	0.925717950	0.142338336	0.235328227	.wM?5™š>t.:?Úûl?šÁ.>âûp>

- The first 32 values of vector C after executing the first warp (32 threads)

Memory 1							
Address: 0x05861c00				Columns: Auto			
0x05861C00	0.564836621	1.00204468	1.06488240	1.24625385	1.56944489	1.03305161	""..¿.C€?.N^??..ÿ?¿âÈ?.;.?
0x05861C18	1.22403646	0.318979442	0.455854952	0.313211471	1.43421733	0.123752557	:.æ?FQ€>ðëé>A] >o"·?ûqý=
0x05861C30	0.386791587	1.10284734	1.20892978	0.829279423	0.802911520	0.664723635	€..>.*.¿6.š?¿KT?æ.M?T+*?
0x05861C48	1.58592486	0.821832895	1.60264897	1.88161874	0.681691945	0.697408974	-ÿÊ?¤cR?š#Í?âðð?]]f.¿e.2?
0x05861C60	1.07184052	1.62331009	1.99649036	1.00393689	0.563493729	0.863887429	.2.¿ ÈÏ?ÿcy?...€? A.¿e'[]?
0x05861C78	0.468489647	0.733420849	-1.#QNAN000	-1.#QNAN000	-1.#QNAN000	-1.#QNAN000	àÿÏ>xÁ;?yyyyyyyyyyyyyyyyyyyy