The x86 language has Turing Complete memory access

An abstract machine having a tape head that can be advanced in 0 to 0x7FFFFFFF increments an unlimited number of times specifies a model of computation that has access to unlimited memory. The technical name for memory addressing based on displacement from the current memory address is relative addressing.

Because the abstract model of computation defined by the x86 language has relative addressing for both control flow and data access this abstract model has control flow and data access to memory far outside of the boundaries of its 32-bit registers.

Jumps to an address that is 7FFFFFFF greater than FFFFFFF5

```
fffffff0: e9ffffff7f        jmp 0xfffffff5 + 0x7fffffff
fffffff5: 90                nop
```

Loads eax with data from an address 7FFFFFFF greater than FFFFFFFF

```
0000014b:  bbffffffff       mov ebx, 0xffffffff
00000150:  8b83ffffff7f     mov eax, dword ptr [ebx+0x7fffffff]
```

The semantics specified by the x86 language could be implemented by a memory architecture organzied as an unlimited sequence of contiguous 4GB blocks. Absolute addressing modes of the 86 language would then only refer to addresses within the current 4GB block. The concept of a current 4GB block would be analogous to the current location of a Turing Machine tape head.

It is only hardware implementations of this abstract model that place any limit on memory access. These hardware limits are implementation details that are not any aspect of the abstract model itself.

The code begins @ machine address 0x100. Fills the 256 bytes preceding it with “@@@@”. Dynamically modifies its own first instruction to refer to its new code address. Copies itself to a new address that is exactly 0x100 bytes above its current code address and then does a relative jump to this new address.

The first 1024 bytes of memory are shown. Then all of the details of four complete cycles an execution trace are listed. Finally the first 1024 bytes of memory are displayed again. The x86 emulator terminates execution after these four complete cycles of execution.

According to the meaning of the syntax of the x86 language this program would continue to operate after it completed its execution @ machine address: FFFFFF00.

The language syntax allows:
(a) Relative Jumps as large as 0x7FFFFFFF even if the EIP = 0xFFFFFFF0.

(b) Data access offsets as large as 0x7FFFFFFF relative to the base register
even if the Base Register = 0xFFFFFFFF.

The only reason that the code would not continue to fill unlimited memory with “@@@@” would be that the physical implementation of the abstract model specified by the x86 language did not implement the semantics specified by the x86 language syntax.

```
100:  B800010000      mov eax, 0x100
105:  8BD8            mov ebx, eax
107:  81EB00010000    sub ebx, 0x100
10d:  C70340404040    mov dword ptr [ebx], 0x40404040
113:  83C304          add ebx, 0x4
116:  3BD8            cmp ebx, eax
118:  7CF3            jl 0x10d
11a:  8B4801          mov ecx, dword ptr [eax+0x1]
11d:  81C100010000    add ecx, 0x100
123:  894801          mov dword ptr [eax+0x1], ecx
126:  8BD8            mov ebx, eax
128:  8BD0            mov edx, eax
12a:  83C241          add edx, 0x41
12d:  8B0B            mov ecx, dword ptr [ebx]
12f:  898B00010000    mov dword ptr [ebx+0x100], ecx
135:  83C304          add ebx, 0x4
138:  3BDA            cmp ebx, edx
13a:  7CF1            jl 0x12d
13c:  E9BF000000      jmp 0x200
```

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1024 byte memory block prior to code execution

```
; - - memory
;           0   1   2   3   4   5   6   7   8   9   a   b   c   d   e   f
00000000:  4c  01  04  00  de  1e  44  5f  9e  03  00  00  18  00  00  00
00000010:  00  00  00  00  2e  74  65  78  74  24  6d  6e  00  00  00  00
00000020:  00  00  00  00  e2  01  00  00  b4  00  00  00  96  02  00  00
00000030:  00  00  00  00  01  00  00  00  20  00  50  60  2e  64  61  74
00000040:  61  00  00  00  00  00  00  00  00  00  00  00  29  00  00  00
00000050:  a0  02  00  00  00  00  00  00  00  00  00  00  00  00  00  00
00000060:  40  00  50  c0  2e  64  65  62  75  67  24  53  00  00  00  00
00000070:  00  00  00  00  ac  00  00  00  c9  02  00  00  00  00  00  00
00000080:  00  00  00  00  00  00  00  00  40  00  10  42  2e  64  72  65
00000090:  63  74  76  65  00  00  00  00  00  00  00  00  28  00  00  00
000000a0:  75  03  00  00  00  00  00  00  00  00  00  00  00  00  00  00
000000b0:  00  0a  00  00  55  8b  ec  51  53  90  90  90  90  90  90  90
000000c0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000000d0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000000e0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000000f0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000100:  b8  00  01  00  00  8b  d8  81  eb  00  01  00  00  c7  03  40
00000110:  40  40  40  83  c3  04  3b  d8  7c  f3  8b  48  01  81  c1  00
00000120:  01  00  00  89  48  01  8b  d8  8b  d0  83  c2  41  8b  0b  89
00000130:  8b  00  01  00  00  83  c3  04  3b  da  7c  f1  e9  bf  00  00
00000140:  00  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000150:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000160:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000170:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000180:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000190:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000001a0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000001b0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000001c0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000001d0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000001e0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
000001f0:  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90  90
00000200:  f4  f4  6a  10  e8  7e  00  00  00  83  c4  04  89  45  fc  f4
00000210:  5b  8b  e5  5d  c3  55  8b  ec  51  8b  45  08  03  45  0c  89
00000220:  45  fc  f4  8b  e5  5d  c3  55  8b  ec  53  56  57  bb  ff  ff
00000230:  ff  ff  8b  83  ff  ff  ff  7f  bb  38  02  00  00  8b  93  ff
00000240:  ff  00  00  8b  f3  8b  fa  8b  06  89  07  83  c6  04  83  c7
00000250:  04  3b  f3  7e  f2  8b  f3  c6  06  00  83  c6  04  3b  f2  7c
00000260:  f6  81  42  01  ff  ff  00  00  ff  e2  90  90  90  90  5f  5e
00000270:  5b  5d  c3  55  8b  ec  5d  c3  55  8b  ec  5d  c3  55  8b  ec
00000280:  5d  c3  55  8b  ec  5d  c3  55  8b  ec  5d  c3  55  8b  ec  5d
00000290:  c3  55  8b  ec  5d  c3  85  01  00  00  10  00  00  00  06  00
000002a0:  11  11  11  11  22  22  22  22  2d  2d  2d  2d  45  6e  64  20
000002b0:  6f  66  20  4d  65  6d  6f  72  79  20  41  6c  6c  6f  63  61
000002c0:  74  69  6f  6e  2a  2a  2a  2a  00  04  00  00  00  f1  00  00
000002d0:  00  9d  00  00  00  62  00  01  11  00  00  00  00  44  3a  5c
000002e0:  5f  48  50  5f  53  74  72  65  61  6d  5c  5f  5f  4e  4c  55
000002f0:  5f  4e  6f  74  65  73  5c  5f  5f  57  6f  72  6b  5f  49  6e
00000300:  5f  50  72  6f  67  72  65  73  73  5c  5f  5f  48  61  6c  74
00000310:  5f  44  65  63  69  64  65  72  5f  58  38  36  5c  5f  52  65
00000320:  61  64  5f  4f  62  6a  65  63  74  5f  46  69  6c  65  5c  48
00000330:  61  6c  74  37  2e  6f  62  6a  00  37  00  3c  11  03  02  00
00000340:  00  06  00  00  00  00  00  00  00  00  00  00  0e  00  10  00  92
00000350:  69  01  00  4d  69  63  72  6f  73  6f  66  74  20  28  52  29
00000360:  20  4d  61  63  72  6f  20  41  73  73  65  6d  62  6c  65  72
00000370:  00  00  00  00  00  2f  44  45  46  41  55  4c  54  4c  49  42
00000380:  3a  4c  49  42  43  4d  54  20  2f  44  45  46  41  55  4c  54
00000390:  4c  49  42  3a  4f  4c  44  4e  41  4d  45  53  20  00  40  63
000003a0:  6f  6d  70  2e  69  64  92  69  03  01  ff  ff  00  00  03  00
000003b0:  40  66  65  61  74  2e  30  30  10  00  00  00  ff  ff  00  00
000003c0:  03  00  2e  74  65  78  74  24  6d  6e  00  00  00  00  01  00
000003d0:  00  00  03  01  e2  01  00  00  01  00  00  00  00  00  00  00
000003e0:  00  00  00  00  00  00  2e  64  61  74  61  00  00  00  00  00
000003f0:  00  00  02  00  00  00  03  01  29  00  00  00  00  00  00  00
```

Execution trace of four complete cycles

```
[0100] b800010000          mov eax,00000100
[0105] 8bd8                mov ebx,eax
[0107] 81eb00010000        sub ebx,00000100
[010d] c70340404040        mov [ebx],40404040
[0113] 83c304              add ebx,+04
[0116] 3bd8                cmp ebx,eax
[0118] 7cf3                jl 0000010d
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[0116] 3bd8            cmp ebx,eax
[0118] 7cf3            jl 0000010d
[010d] c70340404040    mov [ebx],40404040
[0113] 83c304          add ebx,+04
[0116] 3bd8            cmp ebx,eax
[0118] 7cf3            jl 0000010d
[010d] c70340404040    mov [ebx],40404040
[0113] 83c304          add ebx,+04
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[010d] c70340404040    mov [ebx],40404040
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[010d] c70340404040    mov [ebx],40404040
[0113] 83c304          add ebx,+04
[0116] 3bd8            cmp ebx,eax
[0118] 7cf3            jl 0000010d
[011a] 8b4801          mov ecx,[eax+01]
[011d] 81c100010000    add ecx,00000100
[0123] 894801          mov [eax+01],ecx
[0126] 8bd8            mov ebx,eax
[0128] 8bd0            mov edx,eax
[012a] 83c241          add edx,+41
[012d] 8b0b            mov ecx,[ebx]
[012f] 898b00010000    mov [ebx+00000100],ecx
[0135] 83c304          add ebx,+04
[0138] 3bda            cmp ebx,edx
[013a] 7cf1            jl 0000012d
[012d] 8b0b            mov ecx,[ebx]
[012f] 898b00010000    mov [ebx+00000100],ecx
[0135] 83c304          add ebx,+04
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```

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[012d] 8b0b              mov ecx,[ebx]
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[012d] 8b0b              mov ecx,[ebx]
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[0135] 83c304            add ebx,+04
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[0135] 83c304            add ebx,+04
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[0135] 83c304            add ebx,+04
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[012d] 8b0b              mov ecx,[ebx]
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[0135] 83c304            add ebx,+04
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[0138] 3bda              cmp ebx,edx
[013a] 7cf1              jl 0000012d
[012d] 8b0b              mov ecx,[ebx]
[012f] 898b00010000      mov [ebx+00000100],ecx
[0135] 83c304            add ebx,+04
[0138] 3bda              cmp ebx,edx
[013a] 7cf1              jl 0000012d
[013c] e9bf000000        jmp 00000200
[0200] b800020000        mov eax,00000200
[0205] 8bd8              mov ebx,eax
[0207] 81eb00010000      sub ebx,00000100
[020d] c70340404040      mov [ebx],40404040
[0213] 83c304            add ebx,+04
```

```
[0216] 3bd8              cmp ebx,eax
[0218] 7cf3              jl 0000020d
[020d] c70340404040      mov [ebx],40404040
[0213] 83c304            add ebx,+04
[0216] 3bd8              cmp ebx,eax
[0218] 7cf3              jl 0000020d
[020d] c70340404040      mov [ebx],40404040
[0213] 83c304            add ebx,+04
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[020d] c70340404040      mov [ebx],40404040
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[020d] c70340404040      mov [ebx],40404040
[0213] 83c304            add ebx,+04
[0216] 3bd8              cmp ebx,eax
[0218] 7cf3              jl 0000020d
[021a] 8b4801            mov ecx,[eax+01]
[021d] 81c100010000      add ecx,00000100
[0223] 894801            mov [eax+01],ecx
[0226] 8bd8              mov ebx,eax
[0228] 8bd0              mov edx,eax
[022a] 83c241            add edx,+41
[022d] 8b0b              mov ecx,[ebx]
[022f] 898b00010000      mov [ebx+00000100],ecx
[0235] 83c304            add ebx,+04
[0238] 3bda              cmp ebx,edx
[023a] 7cf1              jl 0000022d
[022d] 8b0b              mov ecx,[ebx]
[022f] 898b00010000      mov [ebx+00000100],ecx
[0235] 83c304            add ebx,+04
[0238] 3bda              cmp ebx,edx
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```

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[023a] 7cf1                jl 0000022d
[022d] 8b0b                mov ecx,[ebx]
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[0235] 83c304              add ebx,+04
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[0238] 3bda                cmp ebx,edx
[023a] 7cf1                jl 0000022d
[022d] 8b0b                mov ecx,[ebx]
[022f] 898b00010000        mov [ebx+00000100],ecx
[0235] 83c304              add ebx,+04
[0238] 3bda                cmp ebx,edx
[023a] 7cf1                jl 0000022d
[023c] e9bf000000          jmp 00000300
[0300] b800030000          mov eax,00000300
[0305] 8bd8                mov ebx,eax
[0307] 81eb00010000        sub ebx,00000100
[030d] c70340404040        mov [ebx],40404040
[0313] 83c304              add ebx,+04
[0316] 3bd8                cmp ebx,eax
[0318] 7cf3                jl 0000030d
[030d] c70340404040        mov [ebx],40404040
[0313] 83c304              add ebx,+04
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[0318] 7cf3                jl 0000030d
[030d] c70340404040        mov [ebx],40404040
[0313] 83c304              add ebx,+04
[0316] 3bd8                cmp ebx,eax
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[0318] 7cf3                jl 0000030d
[030d] c70340404040        mov [ebx],40404040
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[030d] c70340404040        mov [ebx],40404040
[0313] 83c304              add ebx,+04
[0316] 3bd8                cmp ebx,eax
[0318] 7cf3                jl 0000030d
[031a] 8b4801              mov ecx,[eax+01]
[031d] 81c100010000        add ecx,00000100
[0323] 894801              mov [eax+01],ecx
[0326] 8bd8                mov ebx,eax
[0328] 8bd0                mov edx,eax
[032a] 83c241              add edx,+41
[032d] 8b0b                mov ecx,[ebx]
[032f] 898b00010000        mov [ebx+00000100],ecx
[0335] 83c304              add ebx,+04
[0338] 3bda                cmp ebx,edx
[033a] 7cf1                jl 0000032d
[032d] 8b0b                mov ecx,[ebx]
[032f] 898b00010000        mov [ebx+00000100],ecx
[0335] 83c304              add ebx,+04
[0338] 3bda                cmp ebx,edx
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[0335] 83c304          add ebx,+04
[0338] 3bda            cmp ebx,edx
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[032d] 8b0b            mov ecx,[ebx]
[032f] 898b00010000    mov [ebx+00000100],ecx
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[0338] 3bda            cmp ebx,edx
[033a] 7cf1            jl 0000032d
[033c] e9bf000000      jmp 00000400
[0400] b800040000      mov eax,00000400
[0405] 8bd8            mov ebx,eax
[0407] 81eb00010000    sub ebx,00000100
[040d] c70340404040    mov [ebx],40404040
[0413] 83c304          add ebx,+04
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[040d] c70340404040    mov [ebx],40404040
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[0418] 7cf3                  jl 0000040d
[040d] c70340404040          mov [ebx],40404040
[0413] 83c304                add ebx,+04
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```

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[0413] 83c304                add ebx,+04
[0416] 3bd8                  cmp ebx,eax
[0418] 7cf3                  jl 0000040d
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[0413] 83c304                add ebx,+04
[0416] 3bd8                  cmp ebx,eax
[0418] 7cf3                  jl 0000040d
[040d] c70340404040          mov [ebx],40404040
[0413] 83c304                add ebx,+04
[0416] 3bd8                  cmp ebx,eax
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[040d] c70340404040          mov [ebx],40404040
[0413] 83c304                add ebx,+04
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[0413] 83c304                add ebx,+04
[0416] 3bd8                  cmp ebx,eax
[0418] 7cf3                  jl 0000040d
[040d] c70340404040          mov [ebx],40404040
[0413] 83c304                add ebx,+04
[0416] 3bd8                  cmp ebx,eax
[0418] 7cf3                  jl 0000040d
[041a] 8b4801                mov ecx,[eax+01]
[041d] 81c100010000          add ecx,00000100
[0423] 894801                mov [eax+01],ecx
[0426] 8bd8                  mov ebx,eax
[0428] 8bd0                  mov edx,eax
[042a] 83c241                add edx,+41
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
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[0435] 83c304                add ebx,+04
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[0435] 83c304                add ebx,+04
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[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
```

```
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
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[042d] 8b0b                  mov ecx,[ebx]
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[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
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[0435] 83c304                add ebx,+04
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[0438] 3bda                  cmp ebx,edx
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[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
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[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[042d] 8b0b                  mov ecx,[ebx]
[042f] 898b00010000          mov [ebx+00000100],ecx
[0435] 83c304                add ebx,+04
[0438] 3bda                  cmp ebx,edx
[043a] 7cf1                  jl 0000042d
[043c] e9bf000000            jmp 00000500
```

1024 byte memory block after code execution

```
; - - memory
;           0   1   2   3   4   5   6   7   8   9   a   b   c   d   e   f
00000000:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000010:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000020:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000030:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000040:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000050:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000060:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000070:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000080:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000090:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000000a0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000000b0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000000c0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000000d0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000000e0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000000f0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000100:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000110:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000120:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000130:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000140:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000150:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000160:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000170:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000180:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000190:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000001a0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000001b0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000001c0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000001d0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000001e0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000001f0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000200:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000210:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000220:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000230:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000240:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000250:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000260:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000270:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000280:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000290:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000002a0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000002b0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000002c0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000002d0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000002e0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000002f0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000300:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000310:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000320:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000330:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000340:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000350:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000360:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000370:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000380:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
00000390:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000003a0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000003b0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000003c0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000003d0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000003e0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
000003f0:  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40  40
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