

OPCODE	Formal	Stack	Mem	Gas
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$		0	0
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 60	0	3
MSTORE	$\mu'_m[\mu_s[0] \dots (\mu_s[0]+31)] \equiv \mu_s[1]$	0 40 1 60	0	6
CALLER	$\mu'_s[0] \equiv I_s$		96	18
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 00000000000000000000000000000000f2	96	20
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 02 1 00000000000000000000000000000000f2	96	23
PUSH2	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+2))$	0 0x0 1 02 2 00000000000000000000000000000000f2	96	26

OPCODE		Formal	Stack	Mem	Gas
EXP				96	29
	$\mu'_s[0] \equiv \mu_s[0]^{\mu_s[1]}$	0 0100 1 0x0 2 02 3 00000000000000000000000000000000f2			
DUP2				96	39
	$\mu'_s[0] \equiv \mu_s[1]$	0 0x1 1 02 2 00000000000000000000000000000000f2			
SLOAD				96	42
	$\mu'_s[0] \equiv \sigma[I_a]_s[\mu_s[0]]$	0 02 1 0x1 2 02 3 00000000000000000000000000000000f2			
DUP2				96	92
	$\mu'_s[0] \equiv \mu_s[1]$	0 0x0 1 0x1 2 02 3 00000000000000000000000000000000f2			

OPCODE	Formal	Stack	Mem	Gas
PUSH20			96	95
	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+20))$	0 0x1 1 0x0 2 0x1 3 02 4 00000000000000000000000000000000f2		
MUL	$\mu'_s[0] \equiv \mu_s[0] \times \mu_s[1]$	0 ffffffffffffffffffffffffffffffff 1 0x1 2 0x0 3 0x1 4 02 5 00000000000000000000000000000000f2	96	98
NOT	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \begin{cases} 1 & \text{if } \mu_s[0]_i = 0 \\ 0 & \text{otherwise} \end{cases}$	0 0x1 1 0x0 2 0x1 3 02 4 00000000000000000000000000000000f2	96	103

OPCODE	Formal	Stack	Mem	Gas
OR	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \mu_s[0]_i \vee \mu_s[1]_i$	0 0xf2 1 0x0 2 02 3 00000000000000000000000000000000f2	96	126
SWAP1	$\mu'_s[0] \equiv \mu_s[1] \mu'_s[1] \equiv \mu_s[0]$	0 0xf2 1 02 2 00000000000000000000000000000000f2	96	129
SSTORE	$\sigma'[I_a]_s[\mu_s[0]] \equiv \mu_s[1]$	0 02 1 0xf2 2 00000000000000000000000000000000f2	96	132
POP	$\mu_s[0] = nil$	0 00000000000000000000000000000000f2	96	20132
CALLVALUE	$\mu'_s[0] \equiv I_v$		96	20134
ISZERO	$\mu'_s[0] \equiv \begin{cases} 1 & \text{if } \mu_s[0] = 0 \\ 0 & \text{otherwise} \end{cases}$	0 0x0	96	20136

OPCODE	Formal	Stack	Mem	Gas
PUSH2	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+2))$	$\mathbf{0} \ 0x1$	96	20139
JUMPI	$J_{\text{JUMPI}}(\mu) \equiv \begin{cases} \mu_s[0] & \text{if } \mu_s[1] \neq 0 \\ \mu_{pc} + 1 & \text{otherwise} \end{cases}$	$\mathbf{0} \ 0050$ $\mathbf{1} \ 0x1$	96	20142
JUMPDEST			96	20152
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$		96	20153
DUP1	$\mu'_s[0] \equiv \mu_s[0]$	$\mathbf{0} \ 01$	96	20156
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	$\mathbf{0} \ 01$ $\mathbf{1} \ 01$	96	20159
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	$\mathbf{0} \ 0x0$ $\mathbf{1} \ 01$ $\mathbf{2} \ 01$	96	20162

OPCODE	Formal	Stack	Mem	Gas
PUSH1			96	20165
	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 02		
		1 0x0		
		2 01		
		3 01		
SWAP1			96	20168
	$\mu'_s[0] \equiv \mu_s[1]\mu'_s[1] \equiv \mu_s[0]$	0 0x0		
		1 02		
		2 0x0		
		3 01		
		4 01		
SLOAD			96	20171
	$\mu'_s[0] \equiv \sigma[I_a]_s[\mu_s[0]]$	0 02		
		1 0x0		
		2 0x0		
		3 01		
		4 01		
SWAP1			96	20221
	$\mu'_s[0] \equiv \mu_s[1]\mu'_s[1] \equiv \mu_s[0]$	0 0xf2		
		1 0x0		
		2 0x0		
		3 01		
		4 01		

OPCODE	Formal	Stack	Mem	Gas
PUSH2			96	20224
	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+2))$	0 0x0		
		1 0xf2		
		2 0x0		
		3 01		
		4 01		
EXP			96	20227
	$\mu'_s[0] \equiv \mu_s[0]^{\mu_s[1]}$	0 0100		
		1 0x0		
		2 0xf2		
		3 0x0		
		4 01		
		5 01		
SWAP1			96	20237
	$\mu'_s[0] \equiv \mu_s[1]\mu'_s[1] \equiv \mu_s[0]$	0 0x1		
		1 0xf2		
		2 0x0		
		3 01		
		4 01		

OPCODE	Formal	Stack	Mem	Gas
DIV	$\mu'_s[0] \equiv \begin{cases} 0 & \text{if } \mu_s[1] = 0 \\ \lfloor \mu_s[0] \div \mu_s[1] \rfloor & \text{otherwise} \end{cases}$	<p>0 0xf2</p> <p>1 0x0</p> <p>2 01</p> <p>3 01</p> <p>4 01</p>	96	20240
PUSH20	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+20))$	<p>0 0xf2</p> <p>1 0x0</p> <p>2 01</p> <p>3 01</p>	96	20245
AND	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \mu_s[0]_i \wedge \mu_s[1]_i$	<p>0 0xf2</p> <p>1 0x0</p> <p>2 01</p> <p>3 01</p> <p>4 01</p>	96	20248
PUSH20	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+20))$	<p>0 0xf2</p> <p>1 0x0</p> <p>2 01</p> <p>3 01</p>	96	20251

OPCODE	Formal	Stack	Mem	Gas
AND	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \mu_s[0]_i \wedge \mu_s[1]_i$	$\mu_s[1]_i$	96	20254
	$\mu_s[0]_i$			
	$\mu_s[1]_i$			
	$\mu_s[2]_i$			
	$\mu_s[3]_i$			
	$\mu_s[4]_i$			
PUSH20	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+20))$	$\mu_{pc}+1$	96	20257
	$\mu_{pc}+20$			
	$\mu_{pc}+1$			
	$\mu_{pc}+20$			
	$\mu_{pc}+1$			
	$\mu_{pc}+20$			
AND	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \mu_s[0]_i \wedge \mu_s[1]_i$	$\mu_s[1]_i$	96	20260
	$\mu_s[0]_i$			
	$\mu_s[1]_i$			
	$\mu_s[2]_i$			
	$\mu_s[3]_i$			
	$\mu_s[4]_i$			
DUP2	$\mu'_s[0] \equiv \mu_s[1]$	$\mu_s[1]$	96	20263
	$\mu_s[0]$			
	$\mu_s[1]$			
	$\mu_s[2]$			
	$\mu_s[3]$			

OPCODE	Formal	Stack	Mem	Gas
MSTORE	$\mu'_m[\mu_s[0] \dots (\mu_s[0]+31)] \equiv \mu_s[1]$		96	20266
	0 0x0			
	1 0xf2			
	2 0x0			
	3 01			
	4 01			
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$		96	20269
	0 0x0			
	1 01			
	2 01			
ADD	$\mu'_s[0] \equiv \mu_s[0] + \mu_s[1]$		96	20272
	0 20			
	1 0x0			
	2 01			
	3 01			
SWAP1	$\mu'_s[0] \equiv \mu_s[1] \mu'_s[1] \equiv \mu_s[0]$		96	20275
	0 0x20			
	1 01			
	2 01			
DUP2	$\mu'_s[0] \equiv \mu_s[1]$		96	20278
	0 01			
	1 0x20			
	2 01			

OPCODE	Formal	Stack	Mem	Gas
MSTORE	$\mu'_m[\mu_s[0] \dots (\mu_s[0]+31)] \equiv \mu_s[1]$	0 0x20 1 01	96	20281
		2 0x20 3 01		
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 0x20 1 01	96	20284
ADD	$\mu'_s[0] \equiv \mu_s[0] + \mu_s[1]$	0 20 1 0x20 2 01	96	20287
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 0x40 1 01	96	20290
SHA3	$\mu'_s[0] \equiv \text{Keccak}(\mu_m[\mu_s[0] \dots (\mu_s[0] + \mu_s[1] - 1)])$ $\mu'_i \equiv M(\mu_i, \mu_s[0], \mu_s[1])$	0 0x0 1 0x40 2 01	96	20293
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 1 01	96	20335

OPCODE	Formal	Stack	Mem	Gas
PUSH2	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+2))$	0 0x0 1 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 2 01	96	20338
EXP	$\mu'_s[0] \equiv \mu_s[0]^{\mu_s[1]}$	0 0100 1 0x0 2 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 3 01	96	20341
DUP2	$\mu'_s[0] \equiv \mu_s[1]$	0 0x1 1 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 2 01	96	20351
SLOAD	$\mu'_s[0] \equiv \sigma[I_a]_s[\mu_s[0]]$	0 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 1 0x1 2 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 3 01	96	20354

OPCODE	Formal	Stack	Mem	Gas
DUP2	$\mu'_s[0] \equiv \mu_s[1]$	0 0x0 1 0x1 2 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 3 01	96	20404
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 0x1 1 0x0 2 0x1 3 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 4 01	96	20407
MUL	$\mu'_s[0] \equiv \mu_s[0] \times \mu_s[1]$	0 ff 1 0x1 2 0x0 3 0x1 4 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 5 01	96	20410

OPCODE	Formal	Stack	Mem	Gas
NOT	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \begin{cases} 1 & \text{if } \mu_s[0]_i = 0 \\ 0 & \text{otherwise} \end{cases}$	0 0xff 2 0x1 3 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 4 01	96	20415
AND	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \mu_s[0]_i \wedge \mu_s[1]_i$	0 0 0xff00 1 0x0 2 0x1 3 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 4 01	96	20418
SWAP1	$\mu'_s[0] \equiv \mu_s[1] \mu'_s[1] \equiv \mu_s[0]$	0 0x0 1 0x1 2 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 3 01	96	20421

OPCODE	Formal	Stack	Mem	Gas
DUP4	$\mu'_s[0] \equiv \mu_s[3]$	0 0x1 1 0x0 2 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 3 01	96	20424
ISZERO	$\mu'_s[0] \equiv \begin{cases} 1 & \text{if } \mu_s[0] = 0 \\ 0 & \text{otherwise} \end{cases}$	0 01 1 0x1 2 0x0 3 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 4 01	96	20427
ISZERO	$\mu'_s[0] \equiv \begin{cases} 1 & \text{if } \mu_s[0] = 0 \\ 0 & \text{otherwise} \end{cases}$	0 0x0 1 0x1 2 0x0 3 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 4 01	96	20430

OPCODE	Formal	Stack	Mem	Gas
MUL	$\mu'_s[0] \equiv \mu_s[0] \times \mu_s[1]$	0 0x1 1 0x1 2 0x0 3 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 4 01	96	20433
OR	$\forall i \in [0..255] : \mu'_s[0]_i \equiv \mu_s[0]_i \vee \mu_s[1]_i$	0 0x1 1 0x0 2 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 3 01	96	20438
SWAP1	$\mu'_s[0] \equiv \mu_s[1] \mu'_s[1] \equiv \mu_s[0]$	0 0x1 1 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 2 01	96	20441
SSTORE	$\sigma'[I_a]_s[\mu_s[0]] \equiv \mu_s[1]$	0 dffe0a64efc769aa3c2e3e99821e6c9a38e82a0aa18f5ed48e1b6e9c118066b6 1 0x1 2 01	96	20444

OPCODE	Formal	Stack	Mem	Gas
POP	$\mu_s[0] = nil$	0 01	96	40444
PUSH2	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+2))$		96	40446
DUP1	$\mu'_s[0] \equiv \mu_s[0]$	0 0403	96	40449
PUSH2	$\mu'_s[0] \equiv c((\mu_{pc}+1) \dots (\mu_{pc}+2))$	0 0403 1 0403	96	40452
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 00d8 1 0403 2 0403	96	40455
CODECOPY	$\forall_{i \in \{0 \dots \mu_s[2]-1\}} \mu'_m[\mu_s[0]+i] \equiv \begin{cases} I_b[0x0] + i & \text{if } \mu_s[1] + i < \ I_b\ \\ 0 & \text{otherwise} \end{cases}$	0 00d8 1 00d8 2 0403 3 0403	96	40458
PUSH1	$\mu'_s[0] \equiv c(\mu_{pc} + 1)$	0 0403	1056	40652

OPCODE	Formal	Stack	Mem	Gas
RETURN	$H_{\text{RETURN}}(\mu) \equiv \mu_{\mathbf{m}}[\mu_{\mathbf{s}}[0] \dots (\mu_{\mathbf{s}}[\overset{\mathbf{0}}{0}] + \overset{\mathbf{0x0}}{\mu_{\mathbf{s}}[1]} - 1)]$		1056	40655
	1 0403			