**Arithmetic and Logic operations**

| commands | return value / return value type | operations |
| --- | --- | --- |
| add | x+y / integer | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *M=M+D*  *@SP*  *M=M-1* |
| sub | x-y / integer | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *M=M-D*  *@SP*  *M=M-1* |
| neg | -x / integer | *@SP*  *A=M-1*  *M=-M* |
| eq | x==y / boolean | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *D=M-D*  *@EQ\_nb*  *D;JEQ*  *@SP*  *A=M-1*  *A=A-1*  *M=0*  *@END\_EQ\_nb*  *0;JMP*  *(EQ\_nb)*  *@SP*  *A=M-1*  *A=A-1*  *M=-1*  *(END\_EQ\_nb)*  *@SP*  *M=M-1* |
| gt | x>y / boolean | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *D=M-D*  *@GT\_nb*  *D;JGT*  *@SP*  *A=M-1*  *A=A-1*  *M=0*  *@END\_GT\_nb*  *0;JMP*  *(GT\_nb)*  *@SP*  *A=M-1*  *A=A-1*  *M=-1*  *(END\_GT\_nb)*  *@SP*  *M=M-1* |
| lt | x<y / boolean | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *D=M-D*  *@LT\_nb*  *D;JLT*  *@SP*  *A=M-1*  *A=A-1*  *M=0*  *@END\_LT\_nb*  *0;JMP*  *(LT\_nb)*  *@SP*  *A=M-1*  *A=A-1*  *M=-1*  *(END\_LT\_nb)*  *@SP*  *M=M-1* |
| and | x And y / Bit-wise | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *M=M&D*  *@SP*  *M=M-1* |
| or | x Or y / Bit-wise | *@SP*  *A=M-1*  *D=M*  *A=A-1*  *M=M|D*  *@SP*  *M=M-1* |
| not | Not x / Bit-wise | *@SP*  *A=M-1*  *M=!M* |

**Push/Pop commands**

| commands | segments | operations |
| --- | --- | --- |
| push constant x  *(x is number)* | contant | *@x*  *D=A*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| push local i | local | *@i*  *D=A*  *@LCL*  *A=M+D*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop local i | local | *@i*  *D=A*  *@LCL*  *D=M+D*  *@addr*  *M=D*  *@SP*  *A=M-1*  *D=M*  *@addr*  *A=M*  *M=D*  *@SP*  *M=M-1* |
| push argument i |  | *@i*  *D=A*  *@ARG*  *A=M+D*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop argument i |  | *@i*  *D=A*  *@ARG*  *D=M+D*  *@addr*  *M=D*  *@SP*  *A=M-1*  *D=M*  *@addr*  *A=M*  *M=D*  *@SP*  *M=M-1* |
| push this i |  | *@i*  *D=A*  *@THIS*  *A=M+D*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop this i |  | *@i*  *D=A*  *@THIS*  *D=M+D*  *@addr*  *M=D*  *@SP*  *A=M-1*  *D=M*  *@addr*  *A=M*  *M=D*  *@SP*  *M=M-1* |
| push that i |  | *@i*  *D=A*  *@THAT*  *A=M+D*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop that i |  | *@i*  *D=A*  *@THAT*  *D=M+D*  *@addr*  *M=D*  *@SP*  *A=M-1*  *D=M*  *@addr*  *A=M*  *M=D*  *@SP*  *M=M-1* |
| push static i | static | *@VMFileName.i*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop static i | static | *@SP*  *A=M-1*  *D=M*  *@VMFileName.i*  *M=D*  *@SP*  *M=M-1* |
| push temp i | temp | *@5+i*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop temp i | temp | *@SP*  *A=M-1*  *D=M*  *@5+i*  *M=D*  *@SP*  *M=M-1* |
| push pointer 0/1  *(push THIS/THAT)* | pointer  0 => THIS  1 => THAT | *@THIS/THAT*  *D=M*  *@SP*  *A=M*  *M=D*  *@SP*  *M=M+1* |
| pop pointer 0/1  *(pop THIS/THAT)* | pointer  0 => THIS  1 => THAT | *@SP*  *A=M-1*  *D=M*  *@THIS/THAT*  *M=D*  *@SP*  *M=M-1* |