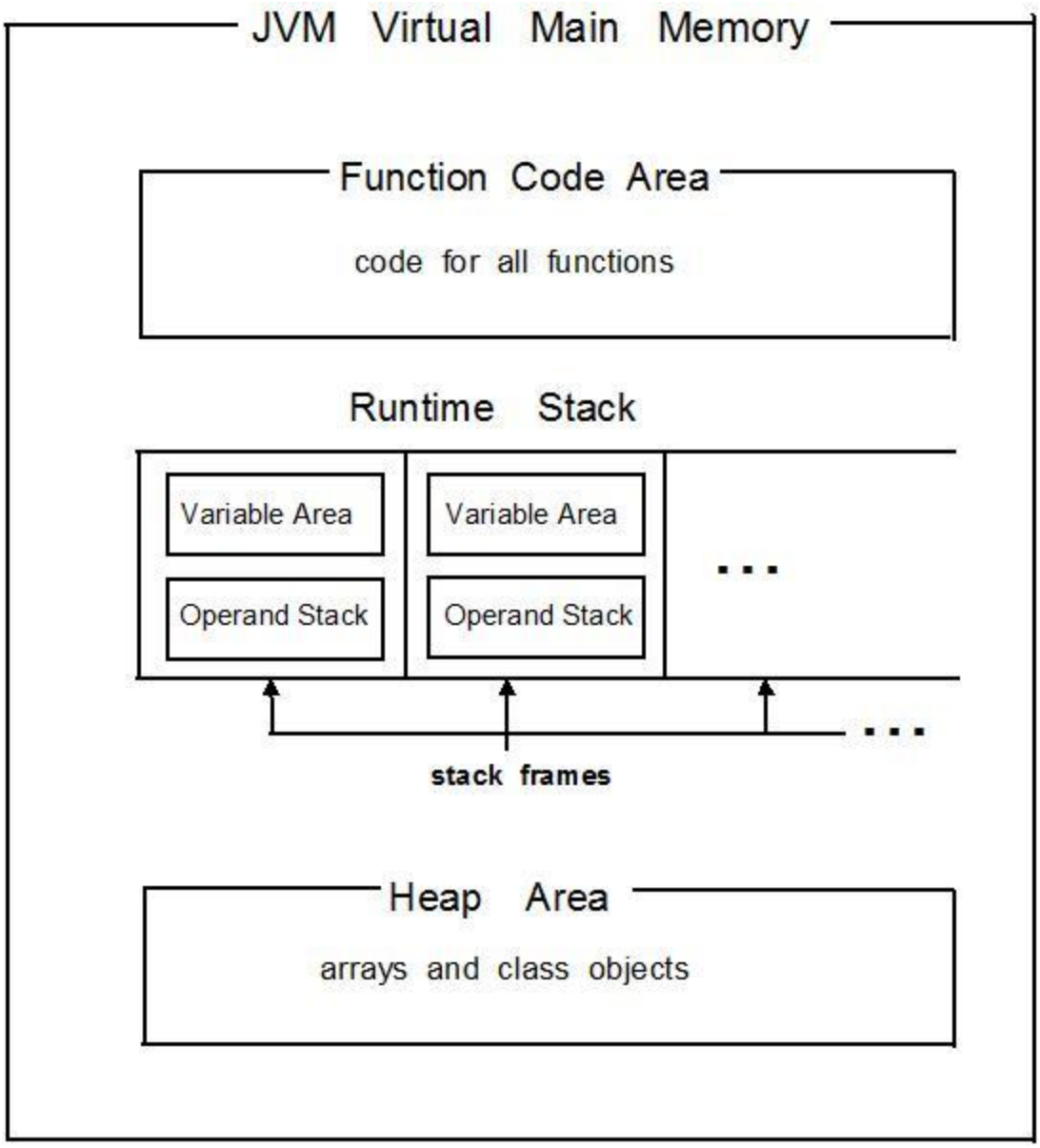
Java Virtual Machine (JVM) is a member of the family of stack-based machines that use operand stacks for expression evaluations. They have no separate, conventional registers – or we could say operand stacks serve as high-level, virtual registers. The JVM has three main components.

- The **function code area** that contains the instructions implementing functions.
- The **runtime stack** that controls function calls. Every function call pushes a new stack frame onto the runtime stack; it is popped when the function returns. Each stack frame contains a **variable area** and an **operand stack**. The variable area contains memory cells for the function's formal parameters and local variables. The operand stack is used to evaluate expressions that appear in the function body; operand stacks are sometimes called evaluation stacks.
- The **heap area** where arrays and class objects are allocated.



The Common Intermediate Language, used for example in Microsoft .NET Framework, is also based on a similar stack-based virtual machine.

Consider this example function where S represents a statement schema.

```
void example()
{
        int i = 0;
        while ( i < 100 )
        {
                S;
                i++;
        }
}
```

The following is an example JVM code that a compiler could generate. For simplicity we assume the function code starts from address 0 in the function code area. In the action description, "stack" refers to the operand stack. First, we assume S is empty.

```
0   iconst_0          push int constant 0 onto stack
1   istore_0          pop stack and store into address 0 in variable area (i=0)
2   iload_0           push value at address 0 onto stack
3   bipush  100       push int constant 100 onto stack
5   if_icmpge  14     pop top two values from stack; if stack[top-1] ≥ stack[top] then go
to 14 (test if i < 100)
8   iinc  0  1        increment value at address 0 by 1 (i++)
11  goto  2
14  return
```

For a non-empty S, we simply insert JVM code for S after the if_icmpge instruction and make necessary increments to instruction addresses.

```
0     iconst_0          push int constant 0 onto stack
1     istore_0          pop stack and store into address 0 in variable area (i=0)
2     iload_0           push value at address 0 onto stack
3     bipush  100       push int constant 100 onto stack
5     if_icmpge  X+14   pop top two values from stack; if stack[top-1] ≥ stack[top] then
go to X+14 (test if i < 100)
      ...
      code for S
      ...
X+8   iinc  0  1        increment value at address 0 by 1 (i++)
X+11  goto  2
X+14  return
```

Here X is the # of bytes occupied by the code for S.

As you might have guessed, any type of "load" instruction pushes a data item onto an operand stack, while any type of "store" instruction pops a data item from the stack and stores it at a location in the variable area.

In the above example, the JVM code is presented in text format. The actual Java ---.class files contain JVM code in binary format. Every JVM instruction occupies one byte in the function code area – hence JVM "bytecode". An operand occupies one or more bytes depending on its instruction.