1. [15 pts] Write a program in machine code for the HP-15C Programmable Calculator to solve the equation below for any input value of $x$. Make sure to provide the addresses of each machine instruction, assuming the first instruction is stored in location 0.

$$y = \frac{3x (x - 5)}{x + 7}$$
2. [20 points] Short answers questions. Make sure to justify your answers in order to get full credit.

   a. True or false: It is of equal importance to eliminate nop instructions whether they occur inside a loop or immediately following an annulled branching instruction at the end of a loop.

   b. Why do we not allow memory to memory operations for the SPARC machine?

   c. Can we replace mov %o1, %o2 with add %o1, %g0, %o2?

   d. Consider the following code as stored in the designated addresses. Provide the values of %r1 and %r2 after tracing the code.

```
mov 22, %r1
mov 35, %r2
subcc %r1, %r2, %r2
bg else
add %r2, 5, %r2
subcc %r1, 3, %r1
ba done
clr %r1
else: add %r2, 5, %r2
done: nop
```
3. [20 points] Trace the assembly code segment as provided for $a = 1$ and $b = 4$. Show values for any register that has changed. Also, rewrite the assembly language code segment below to correct any errors so that the code correctly translates the C code below. Provide a couple of sentences to justify your answer. Assume all registers have been defined.

```c
if a > b
    then a += b
else {
    c = a * b
    b = a
}

mov 10, %o0
cmp %a_r, %b_r
bl,a else
add %a_r, %b_r, %a_r

else:
    mov %a_r, %o1
    mov %b_r, %o2
    call .mul
    mov %b_r, %a_r
    mov %o0, %c_r

done:
```
4. [20 pts] Write a program segment that determines how many input values in the range indicated below for $x$ result in a negative value for $y$.

\[
y = x^3 - 20x
\]

for $x$ in the range of $-10 \leq x \leq 10$. Store the result in \texttt{\%count}. 