Please provide detailed solution as much as possible to receive full credit.

1. Write an ARM assembly code to compute power equation. You have to provide the output (R0) of the input number R1 and R2. Mathematically, it is the power equation i.e., pow(R1,R2) which is equivalent to $R1^{R2}$. You cannot use POW(power), MUL (multiply), DIV (divide), REM (remainder) instruction. E.g., if R1= 5, R2= 3, the output will be R0 = 125. Please optimize your code to use as less number of instructions as possible. (20 points)

2. Optimize dynamic code size (the number of dynamic instruction) for the following ARM code as much as possible. (20 points)

```
        MOV  R10, #2000
        MOV  R0, 10
        MOV  R3, #0
        MOV R4, #0
        MOV R5, #0
        MOV R6, #0
        MOV R7, #4
        MOV R8, #8
Loop:
        LDR  R1, [R10,R7]
        LDR  R2, [R10, R8]
        CMP R1, #0
        BGT TAIL1
        CMP R2, #0
        BGT TAIL1
        CMP R1, #1
        BNE TAIL1
        ADD R3, R3, #1
        ADD R5, R5, #1
        B TAIL2
TAIL1:
        SUB R3, R3, #1
TAIL2
        ADD R4, R3, R2
        ADD R6, R5, R4
END:
        MOV  R10, #2000
        ADD R7, R7, #4
```

```
        ADD R8, R8, #4
        CMP R0, #0
        BGT Loop
END1:
        STR R6, [R10,#0]
```

3) Given the positive integer variable a, write a Python program to find the fibonanci number
 (FN) e.g, FN(8) is 21. The Fibonacci number is calculated as follows:

FN(0) = 0,
FN(1) = 1,
FN(N) = FN(N-1) + FN(N-2)

 (20 points)

4)

a) Assuming all task comes in the ascending order (T1 comes first, then T2 and so on. T8 comes
last) before time 0. Please calculate the waiting time for FIFO scheduling, SJF scheduling, and
round robin using time slice of 10 seconds (only for round robin). Note that for FIFO and SJF
scheduling, once the task is scheduled, it has to be executed until completion. Please provide
details calculation and justify which is the best methods (10 points)

Task	T1	T2	T3	T4	T5	T6	T7	T8
Run time	79	69	59	49	39	29	19	9

b) Assume that HP task is high priority task, MP is medium priority task, and LP is low priority
task.

	T1	T2	T3	T4	T5	T6	T7	T8
HP task			B					
MP1 task								
MP2 task		B A					B	
LP task	A					A		

In the table, the blue color is processing task. The grey color is blocking task. From the above
table, LP task comes at time T1 and acquires mutex A. The Medium priority task T2, then comes
at time T2. It acquires mutex B and is trying to acquire mutex A (but have to go to sleep, waiting
for LP task). The HP task comes at time T3 and it is trying to acquire mutex B, (but have to go to
sleep, waiting for MP2 task). Then, MP1 tasks come and can run until the completion. Once MP1
is complete, LP task, MP2, and HP tasks can be run respectively.

Please describe whether we have any problems here or not. If yes, how to solve it. (10 points)

5) You have been asked to design the prototype system for COVID scan using infrared sensor and camera. The microcontroller is based on Raspberry Pi. The user must walk through the camera and place the hand near infrared sensor to acquire temperature information. We use Raspberry Pi camera and temperature connected through RS232 communication. The sensor reports the temperature in Celsius and if it is less than 37.5, the system will show the green light LED, otherwise it will show the red light LED. The green-light LED is connected via GPIO Port 17 (BCM) and the red-light LED is connected via GPIO port 18. (20 points)