C++ coding challenge

In the following, there are **three** coding questions to be completed. Please modify the *CMakeLists.txt* for these questions. The cmake portion for question 2 is provided as a hint. Simply create a build folder on the same level as main_question2.cc and run "cmake .. && make" in the build directory to compile.

1. Please write a function **std::string ExpandPowersOf(const int& m)** to express the expansion $(p+q)^m$. For example, **ExpandPowersOf(2)** should give the expression **p^2+2pq+q^2**. Similarly, for **ExpandPowersOf(-2)** gives **1/(p^2+2pq+q^2)**

2. Imagine that we are programming a robot arm to give massages to a patient in a medical application. For safety reasons, we want to monitor the amount of mechanical power the robot is applying. If the absolute value of the mechanical power exceeds a given threshold, the robot will stop. In other words, symbolically

$$|\boldsymbol{f}^T \dot{\boldsymbol{x}}| > threshold$$

where power is defined as the inner product of the applied linear force and linear velocity of the system.

a. Modify the code to compute the power done by the robot tool on the patient, each servo cycle. Use a 10 sample moving average filter for power monitoring.
b. What servo cycle does it stop on?
c. What is the big O complexity of Update() as a function of kWindowSize?
d. Your friend claims that she can implement a moving average filter with O(1) complexity, as a function of window size. How would you change your implementation to achieve that, and are there any potential issues?

3. Supposed that you are writing unit tests for the RobotMonitor class.

a. Please list three assertions that you would like to include in your tests.
b. If you decided to go with google test as your test framework, how would you best design your directory structure? You can either explain it here or rearrange the files in the given directory and update the CMakeLists.txt
c. [Bonus] If you have additional time, please include the unit test implementation in the updated directory structure.

Please send us back our solutions in a zipped folder. Good luck!