1. The gunner on a small assault boat fires three missiles at an attacking plane. Each has a 20% chance of being on target. If two or more of the shells find their mark, the plane will crash. At the same time, the pilot of the plane fires 4 air-to-surface rockets, each of which has a 0.1 chance of destroying the boat. If one or more of the rockets hit the boat, the boat will sink. Would you rather be on the plane or the boat? (That is, please calculate and compare the probability that the plane will crash and the probability that the boat will be destroyed.)

2. A miner is trapped in a mine with 3 doors.

• The 1st door leads to a tunnel that will take him to safety after 3 hours.
• The 2nd door leads to a tunnel that returns him to the mine after 5 hours.
• The 3rd door leads to a tunnel that returns him to the mine after 7 hours.
At all times, he is equally likely to choose any one of the doors.
Question: What is the expected time for the miner to reach safety?

3. Let $X_1,\ldots,X_n \overset{i.i.d.}{\sim} N(\mu,\sigma^2)$, be a random sample from the normal population where μ is assumed known. Please derive:

(a) The maximum likelihood estimator for σ^2.
(b) The method of moment estimators for σ^2.
(c) Are the above estimator(s) for σ^2 unbiased?
(d) Are these two estimators identical?