PCS Exam 2023 - Feedback

- z being given, you had to solve for t in
$$z = \frac{2\sinh t}{1+2\cosh t} = \frac{e^{t}-e^{-t}}{1+e^{t}+e^{-t}}$$
Changing variables to $X = e^{t}$ yields a simple equation

- When a random variable X is such that "X and $-X$ are equally probable", it does not mean that X only takes two values.

- With $\dot{x} = \frac{1}{m\gamma} F$ ($\dot{x}$ ← velocity, m ← mass, F → force), there are about 20% errors for the physical dimension of γ (an inverse time) → not acceptable

- When the sum of IID random variables is such that the central limit theorem holds, this only yields the large deviation function $\phi(z)$ for $z \to 0$ (and it is then quadratic).

- When $x_n = \sum_{i=1}^{n} \eta_i$ and the η are IID, then the variance $V(x_n) = n\,V(\eta)$. This is a basic property of the variance, that can avoid messy calculations, going through $\langle \sum_{i,j} \eta_i \eta_j \rangle$ ...
Too many errors on that

- $\langle e^{tX} \rangle = e^{t\langle X \rangle} e^{t^2\sigma^2/2}$ only holds for a gaussian variable

- For the random walk in discrete time $x_n = \sum_{i=1}^{n} \eta_i$
  → if the η_i have a Pareto index $\mu < 2$ then the walk is superdiffusive
  → if the Pareto index is $\mu > 2$, the walk is <u>not</u> subdiffusive, but simply diffusive.

- When applying the Sanov theorem for computing a large deviation function, it is important to specify the alphabet over which the distribution is defined, before minimizing the Kullback-Leibler distance.
In C, this alphabet was $\{-1, 0, 1\}$