

Moment generating function

Moment generating function $M_x(\Theta)$ is by definition equal to

$$M_x(\Theta) = \int_{-\infty}^{\infty} e^{\Theta x} f(x) dx \quad (1)$$

where Θ is a parameter, $f(x)$ is probability density function of random variable X

$$\begin{aligned} M_x(\Theta) &= \int_{-\infty}^{\infty} \left[1 + \Theta x + \frac{\Theta^2 x^2}{2!} + \frac{\Theta^3 x^3}{3!} + \dots \right] f(x) dx \\ &= 1 + \Theta \mu'_1 + \frac{\Theta^2}{2!} \mu'_2 + \frac{\Theta^3}{3!} \mu'_3 + \dots \end{aligned} \quad (2)$$

We have then

$$\mu'_k = \left. \frac{d^k M}{d\Theta^k} \right|_{\Theta=0} \quad (3)$$

References

- [1] Hoel, Paul G. (1966) *Introduction to Mathematical Statistics* John Wiley & Sons, Inc., New York, London, Sydney

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