Probability and Measure Theory Review

Probability Basic	Inequalities	4-Dummies	Measure Theory	Limits
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400

Player A

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Probability Basic for 100.

The space of events $\mathcal{F}$ for Ω satisfies:

a $\Omega \notin \mathcal{F}$

b $\emptyset \in \mathcal{F}$

c $A \in \mathcal{F} \Rightarrow A \in \mathcal{F}^C$

d $A_1, A_2, ..., A_n, ... \in \mathcal{F} \Rightarrow \bigcup_{n=1}^{\infty} A_n \in \Omega$

e none of them

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Probability Basic for 200.

A probability P on $(\Omega, \mathcal{F})$ satisfies

a $P(\Omega) \geq 1.2$

b $P(A \cup B) = P(A) \cup P(B) - P(A \cap B)$

c For disjoint sets in $\mathcal{F}$, $P\left(\bigcup_{n=1}^{\infty} A\right) = \sum_{n=1}^{N} P(A_n)$

d $P(\emptyset) < 0$

e none of them

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Probability Basic for 300.

Conditional probability $P(A|B)$ equals

- a $P(A \cap B)$
- b $P(A) \cdot P(B)$
- c $(P(B) \times 1/P(A \cap B))^{-1}$
- d $P(A) + P(B) - P(A \cap B)$
- e $P(A - B)$
- f This class is boring

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Probability Basic for 400.

X is a random variable iff

a $\forall \alpha \in \mathbb{R} \ \{\omega : X(\omega) \geq \alpha\} \notin \mathbb{X}$

b $\exists \alpha \in \mathbb{R} \ \{\omega : X(\omega) \geq \alpha\} \in \mathbb{X}$

c $\exists \alpha \in \mathbb{R} \ \{\omega : X(\omega) < \alpha\} \in \mathbb{X}$

d $\forall \alpha \in \mathbb{R} \ \{\omega : X(\omega) = \alpha\} \in \mathbb{X}$

e none of them

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Inequalities for 100.

Boole's Inequality states that

a $E[g(X)] \geq g(E(X))$ for g convex

b $P\left(\bigcup_{n=1}^{\infty} A_n\right) \leq \sum_{n=1}^{\infty} P(A_n)$

c $P(|X-\mu| \geq a) \leq \frac{\sigma^2}{a^2}$

d $P(|X| \geq a) \leq \frac{1}{a} E(|X|)$

e none of them

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Inequalities for 200.

Markov Inequality states that

a. $P(\Omega) \geq 1.2$

b. $P(A \cup B) = P(A) \cup P(B) - P(A \cap B)$

c. For disjoint sets in $\mathcal{F}$, $P\left(\bigcup_{n=1}^{\infty} A_n\right) = \sum_{n=1}^{N} P(A_n)$

d. $P(\emptyset) < 0$

e. $P(|X| \geq a) \leq \frac{1}{a} E(|X|)$

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Inequalities for 300.

Chebyshev's inequality concludes that

- a $E[g(X)] \geq g(E(X))$ for g convex
- b $P\left(\bigcup_{n=1}^{\infty} A_n\right) \leq \sum_{n=1}^{N} P(A_n)$
- c $P(|X-\mu| \geq a) \leq \frac{\sigma^2}{a^2}$
- d $P(|X| \geq a) \leq \frac{1}{a} E(|X|)$
- e This class is boring

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Inequalities for 400.

Jensen Inequality states that

a $E[g(X)] \geq g(E(X))$ for g convex

b $P\left(\bigcup_{n=1}^{\infty} A_n\right) \leq \sum_{n=1}^{N} P(A_n)$

c $P(|X-\mu| \geq a) \leq \frac{\sigma^2}{a^2}$

d $P(|X| \geq a) \leq \frac{1}{a} E(|X|)$

e none of them

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4-Dummies for 100.

What is $(A^c)^c$?

a $\emptyset$

b X

c $\{A\}$

d $A - X$

e $X - A$

f X^c

g none of them

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4-Dummies for 200.

The complement of $\bigcap_{m=1}^{\infty} E_m$ is

a $\bigcup_{m=1}^{\infty} E_m$

b $\bigcap_{m=1}^{\infty} E_m^c$

c $\bigcap_{m=1}^{\infty} E_m^c$

d $\bigcup_{n=1}^{\infty} E_n^c$

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4-Dummies for 300.

If X is a set, what is 2^X?

a 2 raised to the power X

b 2 times 2 times 2 ... X times

c The X power of 2

d all subsets of X

e I do not give a dime

f The power rangers

g none of them

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4-Dummies for 400.

In Measure Theory, what does LDCT mean ?

a Lower Derivative Control Theorem

b Least Derivative Common Term

c Lightweight Digital Command Terminal

d Lebesgue's Dominated Convergence Theorem

e Leibniz Derivative Convergence Theory

f Lagrange D' Cumulative Term

g Laplace Derivative Continuous Theorem

h none of them

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Measure Theory for 100.

If $(X, \mathcal{F}, \mu)$ is a measure space and $x \in A$, what is the value of $\chi_{A}(x)$?

a -1

b 0

c 1

d x

e Ax

f $\mu(A)$

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Measure Theory for 200.

If $(X, \mathcal{F}, \mu)$ is a measure space and $A \in \mathcal{F}$, what is the value of $\int \chi_A d\mu$?

a -1

b 0

c 1

d x

e Ax

f $\mu(A)$

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Measure Theory for 300.

What is the Lebesgue measure?

a It is about the Riemann integral

b It is the integral

c To each interval assigns its length

d $P(A \cap B) = P(A) \cdot P(B)$

e $P(|X| \geq a) \leq \frac{1}{a} E(|X|)$

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Measure Theory for 400.

What does Radon Nikodym theorem conclude?

a $\dfrac{X_1 + X_2 + \cdots + X_n}{n} \longrightarrow \mu$

b $\lim \displaystyle\int f_n \, d\mu = \int f \, d\mu$

c there is f with $\lambda(A) = \displaystyle\int_A f \, d\mu$

d there is a measure that extends to a sigma algebra

e the moment generating function

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Limits for 100.

CLT states that if X_n are i.i.d.r.v. with mean 0 and variance 1, then , $\frac{X_1 + X_2 + \cdots + X_n}{\sqrt{n}}$ converges to

- a μ
- b 1
- c normal random variable mean 0, variance 1
- d Of course the mean
- e the variance?
- f X_1

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Limits for 200.

LDCT concludes that $\lim_{n\to\infty} \int f_n \, d\mu = \int f \, d\mu$. What are the hypotheses?

- a $0 \le f_n \le f_{n+1}$, f_n measurable
- b $0 \le f_n \le f_{n+1}$, $f_n \to f$, f_n measurable
- c $0 \le f_n \longrightarrow f$, f_n measurable
- d $g \ge |f_n| \longrightarrow f$, f_n measurable, g integrable
- e f_n increasing sequence of measurable functions converging to f

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Limits for 300.

If $0 \leq f_n \leq f_{n+1}$ are measurable and converge to f, MCT states

a $$\frac{X_1 + X_2 + \cdots + X_n}{\sqrt{n}} \longrightarrow 1$$

b $$P\left(\bigcup_{n=1}^{\infty} A_n\right) \leq \sum_{n=1}^{\infty} P(A_n)$$

c $$\frac{X_1 + X_2 + \cdots + X_n}{n} \longrightarrow \mu$$

d $$\lim_{n\to\infty} \int f_n \, d\mu = \int f \, d\mu.$$

e $$P(|X| \geq a) \leq \frac{1}{a} E(|X|)$$

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Limits for 400.

If $0 \leq f_n$ are measurable, Fatou's lemma states

a $\int \liminf f_n \, d\mu \leq \liminf \int f_n \, d\mu$

b $\dfrac{X_1 + X_2 + \cdots + X_n}{n} \longrightarrow \mu$

c $\lim_{n\to\infty} \int f_n \, d\mu = \int f \, d\mu.$

d $\dfrac{X_1 + X_2 + \cdots + X_n}{\sqrt{n}} \longrightarrow 1$

e there is f with $\lambda(A) = \int_A f \, d\mu$

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