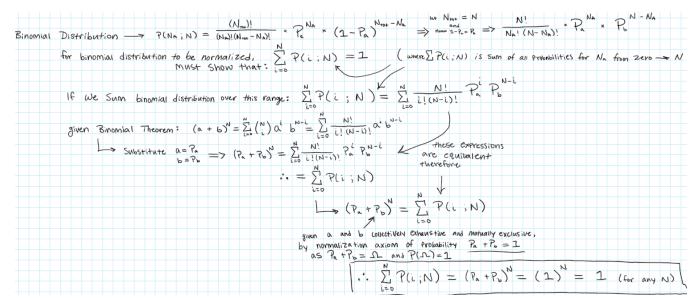
BPC

Problem Set 1

Written Component

Secret Code: 20

<u>B1:</u>



<u>B2:</u>

• See Jupyter notebook for solution.

B3:

• See Jupyter notebook for solution.

<u>B4:</u>

$$P(K) = \frac{2,000}{300,000,000} \text{ and } P(F) = \frac{200}{300,000,000}$$

$$\text{Mant:} P(F \cap K) = P(F) \cdot P(K_A) = \frac{200}{300,000,000} \times \frac{200}{300,000,000}$$

$$\text{Where F is outcome that any given Person in Country is on Fight and K is outcome that you Know any given Person in country}$$

$$P(K_A) = \sum_{i=1}^{200} P(i; 200) = \sum_{i=1}^{200} {200 \choose i} \times P_{F_{nK}}^{i} \times (1 - P_{F_{nK}})^{i} \approx 8.88 \times 10^{-10}$$

$$\text{Probability of Knowing At least 1 Person on Fight given P_{F_{nK}}}$$

• See Jupyter notebook for confirmation of solution.

BPC

Problem Set 1

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<u>C1:</u>

C1:
a)
$$f(x) = 3x^{4} + 2x + 5$$

$$f'(x) = 12x^{3} + 2$$
b) $f(x) = \frac{Kx}{1+Kx}$

$$f'(x) = \frac{(1+Kx)(K) - (Kx)(K)}{(1+Kx)^{2}} = \frac{K+K^{2}x - K^{2}x}{(1+Kx)^{2}} = \frac{K}{(1+Kx)^{2}}$$
c) $f(x) = \ln(x) + e^{-Kx}$

$$f'(x) = \frac{1}{x} + e^{-Kx}(-K)$$

$$= \frac{1}{x} - Ke^{-Kx}$$

<u>C2:</u>

$$\frac{C \lambda}{a} = \frac{1}{4} + \frac{$$

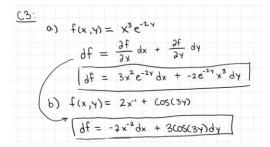
BPC

Problem Set 1

Written Component

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<u>C3:</u>



<u>C4:</u>

CH: De exact if and only if

for:
$$dQ = A(x y) dx + B(x,y) dy$$

$$\left(\frac{\partial A}{\partial y}\right)_{x} = \left(\frac{\partial B}{\partial x}\right)_{y}$$
a) $df(x,y) = 4x^{3}y dx + x^{4} dy$

$$\left(\frac{\partial A}{\partial y}\right)_{x} = 4x^{3} \quad \therefore \quad \frac{\partial A}{\partial y} = \frac{\partial B}{\partial x} \quad \text{and} \quad \text{if is exact}$$

$$\left(\frac{\partial B}{\partial x}\right)_{y} = 4x^{3} \quad \therefore \quad \frac{\partial A}{\partial y} = \frac{\partial B}{\partial x} \quad \text{and} \quad \text{if is exact}$$
and $f(x,y) = x^{4}y + C$
b) $df(x,y) = xy^{4}dx + yx^{4}dy$

$$\left(\frac{\partial A}{\partial y}\right)_{x} = -2xy^{-2}$$

$$\left(\frac{\partial A}{\partial y}\right)_{y} = -2yx^{-2}$$

$$\left(\frac{\partial A}{\partial y}\right)_{y} = -2yx^{-2}$$

$$\left(\frac{\partial A}{\partial y}\right)_{y} = -2yx^{-2}$$

<u>C5:</u>

$$\frac{(5:6)}{3} \int_{1}^{3} x \, dx = \left[\frac{3}{2}x^{2} + C\right]$$

$$= \int_{1}^{4} \left[x^{3} + 2\right] dx = \frac{x^{4}}{4} + 2x \quad \left|\frac{4}{1}\right| = \left[\frac{(4)^{4}}{(4)^{4}} + 2(4)\right] - \left[\frac{(1)^{4}}{4} + 2(1)\right]$$

$$= \left[72 \quad - \frac{1}{4} \quad - \frac{1}{4}\right]$$

$$= 72 - \frac{9}{4} = \left[69.75\right]$$

$$C) \int y^{2}e^{-2x} \, dx = y^{2} \int e^{-3x} \, dx$$

$$= y^{2} \cdot \frac{1}{3} \int -2e^{-3x} \, dx = -y^{2} \cdot \frac{1}{3} \int e^{u} \, du$$

$$= -\frac{y^{2}}{2} \left[e^{u} + C\right]$$

$$= \frac{-y^{2}}{2} \left[e^{-2x} + C\right]$$