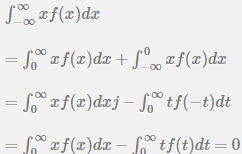
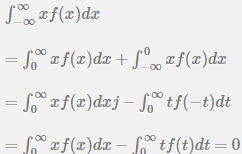
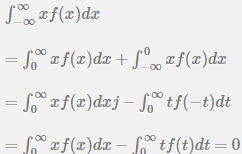
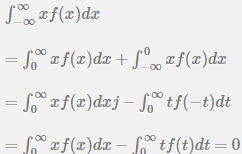
**QUIZ**

* P(B∩Ac) is always equal to?
* **P(B)−P(B∩A)**
* When does *P*(*A*∪*B*) = *P*(*A*) + *P*(*B*)? Check all that apply.
* **When P(A∩B)=0**
* ~~When A and B are independent.~~
* ~~Always~~
* **When A and B are mutually exclusive (*same as statement 1)***
* What is the probability of getting at least 1 head on 3 coin flips expressed as a % to one decimal?
* P(HTT ∪ HHT ∪ HHH) 🡪 equals sum of probabilities ONLY when events are *mutually exclusive*
* *Otherwise* it equals probability each minus other things (intersections)
* **P(at least one) = 1 – P(none)** 🡪 1 – P(all tails) = 1 – P(½^3) = 1 - .125 = .875 = **87.5**
* Suppose a random variable, X, follows a uniform distribution (i.e. has a density that is a constant 1 between 0-1. What is the probability X is between .1-.7, expressed as an integer % (no decimals)?
* Integrate 1 from .1 to .7 🡺  🡺 .7 - .1 = .6 **= 60%**
* Suppose a random variable follows a density **cx** for 0≤x≤1. What is c?
*  🡺 **c = 2**
* Suppose a density is of the form  for x between 0-1. What is the distribution function associated with this density?
* INTEGRATE! **🡪 x^3** 🡺
* Suppose the time in days until hospital discharge for a certain patient population follows a density for x>0. Calculate probability a person takes longer than 11 days to be discharged. Express it as an integer percentage with no digits after the decimal.
* **Integrate the function from 11 to infinity 🡪** 
* Derivative/integral of e^-x/10 = -e^(-x/10) 🡺 
* Multiply by 100 for %
* Suppose **h** is a **real valued** function such that h≥0 and . Then ch is a valid density when c is equal to?
*  🡺 b/c *integral of h(x)c over all real #’s must = 1*
* *Something < 1 multiplied by its inverse = 1*
* 
* Consider a health care worker without the flu. Suppose they have a p=.01 probability of getting infected after an examination of an infected patient. His chance of getting infected after the ith interaction is assumed to be for i=1,2,…. What is the probability of getting infected after 3+ interactions expressed as to the nearest integer percentage? (no decimal places.)
* **P(X >= 3) = 1 – P(not >= 3) 🡺 1 – P(2) – P(1) 🡺 1 - .01 - .0099 == .9801 = 98%**
* Consider a **geometric random variable**, X which has **mass function** for x=1,2,…. (assume this sums to 1 so that its valid) What is the probability X>5?
* **Sum the function from 6 to infinity** 
* **Factor out a (1-p)^5 == subtract 5 from the formula w/in the sum**
* **Subtract 5 from the exponent + the lower bound of the sum**
* Let **g(x)=πf1(x) + (1−π)f2(x)** where f1 and f2 = densities w/ means μ1 and μ2 + associated variances σ1^2 and σ2^2, respectively. Here 0≤π≤1. Note that *g is a valid density*. What is E[X^2] where X is a random variable having density g?
* 
* **Therefore,** 
* Suppose a density is of the form  for some constant k>1 and that 0≤x≤1. What is where **n** is an integer and **X** is a random variable from this density?
* 
* You are playing a game with a friend where you flip a coin and if it comes up heads you give her $2, if it comes up tails she gives you $1. You play 10 times. What is the expected total earnings for you?
* P(H)\*winning/loss + P(T)\*winnings/loss = P(H)\*-2 + P(T)\*1 = P(T) – 2P(H) = ½ - 2\*(½) 🡪 10(½ - 2\*(½)) = 10(-½) = -5 🡺 **Loss of five dollars**
* 
* When at the free-throw line, a player makes at least 1 free throw 90% of the time. 80% of the time, the player makes the 1st shot, while 70% of the time she makes both shots. Does it appear that the player's second shot success is independent of the first?
* **No 🡪** A = makes 1st shot, B = makes 2nd shot **🡪** P(A∪B) = .9**,**P(A)=.8, P(A ∩ B) = .7
* Then P(B) = P(A∪B) − P(A) + P(A∩B) =.8
* **Then, P(A∩B) ≠ P(A)×P(B)**
* Let X be a random variable with mean μ and variance σ^2. What is the variance of ?
* 
* Let X1,…,Xn1 be random variables independent of Y1,…,Yn2, where both groups are iid with associated population means μ1 and μ2 and population variances σ1^2 and σ2^22, respectively. Let X¯ and Y¯ be their sample means. What is the mean of X¯− Y¯?
* **μ1−μ2 🡪** 
* The Poisson mass function is given by  for x=0,1,2,3,… and λ>0. What is **E[X(X−1)]** where X is a Poisson random variable?
* 
* 
* Let f be a density such that f(x)=f(−x). What is the associated mean of this density (assuming it has a mean)?
* 
* 
* For a Bernoulli coin flip w/ P(H) = p, what is the value of p that yields the largest variance?
* Variance = 
* Derive = , which, solving for p = 0, gives p = .5
* A 2nd derivative = 2 suggests the function is **concave (**f’’ > 0), and p = .5 == the max (gradient = 0 @ p = .5)
* Let f be a mean 0 variance 1 density. Let g(x)=f{(x−μ)/σ}/σ. Argue to yourself that g is a valid density. What is the variance associated with g?
* 
* 
* 
* So, the mean associated w/ g is = μ, then considering the variance:
* 
* 
* What is P(A∪B) always equal to?
* **1 − P(Ac ∩ Bc)**
* Which of the following are always true about? (Check all that apply.)
* It is smaller than or equal to ∑ni=1P(Ei).
* It is smaller than maxiP(Ei).
* **It is equal to ∑ni=1P(Ei)**
* It is larger than or equal to miniP(Ei).
* It is larger than or equal to maxiP(Ei).
* It is smaller than miniP(Ei).
* Consider influenza epidemics for 2 parent heterosexual families. Suppose the probability is 17% that at least 1 parent has contracted the disease. The probability the father has contracted influenza is 12% while the probability that *both* the mother + father have contracted the disease is 6%. What is the probability that the mother has contracted influenza?
* P(F U D) = .17 P(F **∩** D) = .6 P(D) = .12
* P(F U D) = P(F) + P(D) - P(F **∩** D) 🡺 .17 = F + .12 - .6 🡺 .23 = F + .12 🡺 F = .11 = **11%**
* A random variable, X is uniform, so that it's density is f(x)=1 for 0≤x≤1. What is it's 75th percentile?
* **.75**
* A Pareto density is 1/x^2 for 1<x<∞. What is the distribution function associated with this density for 1<x<∞?
* integrate 1/x^2 from x to inf = **survival function**
* Distribution = 1 – Survival 🡪 1 – S(x) 🡺 **1 – (1/x)**
* What is the quantile p from the density 
* Ex:  
*  🡺  == p
* = -p 🡺  = -(1/p – 1) 🡺 x =



* Suppose that a density is of the form cxk for some constant k>1 and 0<x<1. What is the value of c?
*  🡺 need this to = 1 🡺 **c = k+1**
* Suppose that the time in days until hospital discharge for a certain patient population follows a density f(x)= ½( ) for x>0. What is the median discharge time in days?
*  **=** median = 50th quantile = .5
*  **= .5 🡺**  == ln(50) 🡺 xp = -2\*ln(.5) == -(-1.38) = **1.4**
* Consider the density given by  for x>0. What is the median?
*  == .5 🡺 x =  = .83
* Suppose h(x) is such that ∞>h(x)>0 for x=1,2,…,*I*. Then ch(x) is a valid PMF when c is equal to what?
*  **(inverse b/c it should be = 1 when multiplied by** **)**
* Let  where f1 and f2 are densities with associated means μ1 and μ2, respectively. Here 0≤π≤1. Note that g is a valid density. What is it's associated mean?
* 
* **==** 
* Suppose that a density is of the form  for some constant k>1 and 0≤x≤1. What is the mean associated with this density?
* Mean = expected value of a random variable X w/ the distribution equal to the PFD above
*  🡺  == **k+1/k+2**
* You are playing a game w/ a friend, flipping a coin + if it comes up heads you give her $X + if it comes up tails she gives you $Y. The probability the coin is heads in p (some number between 0-1) What must be true about X and Y to make so that both of your expected total earnings = 0? (game is fair)
*  = 10\*(-X\*p + Y\*(1-p))
* Want this = 0 🡺 10\*(-X\*p + Y\*(1-p)) == 0 🡺 Y\*(1-p) = -X\*p 🡺 -Y/X = p/(1-p) == 
* You are playing a game with a friend, flipping a coin + if it comes up heads you give her $1, if it comes up tails she gives you $1. If you play 10 times, what would be the variance of your earnings?
* P(H)\*winning/loss + P(T)\*winnings/loss = P(H)\*-1 + P(T)\*1 = P(T) – P(H) = $0 for expected earnings
* 
* **E[X] =** 0 **E[X]^2 = 0**
* **E[X^2]** = (1-p)^2 + 1\*p^2 = 2p^2 – 2p + 1 == 2p^2 = .5
* **Var(X) = E[X^2] – E[X]^2** = 10(.5 – 0) = 5?
* 10
* 10−−√
* **~~1~~**
* 2
* **~~√2 ????~~**
* When at the free-throw line, a player makes at least 1 free throw 90% of the time. 80% of the time, the player makes the 1st shot, while 70% of the time she makes both shots. Which number is closest to the conditional probability that the player makes the second shot given that she missed the first?
* A = makes 1st shot, B = makes 2nd shot **🡪** P(A∪B) = .9**,**P(A)=.8, P(A ∩ B) = .7
* Then P(B) = P(A∪B) − P(A) + P(A∩B) = .8
* pA = 0.8 pB = 0.8 pBc = 1 - pB = .2 pAUB = 0.9 pAIB = 0.7
* pAcIB = (1 - pAIB) = .3 pAcIBc = (1 - pAIB) = .3
* pAcGBc = pAcIBc/pBc = .3/.2 pAcGB = pAcIB/pB = .3/.2
* # From Bayes Theorem **P(B | A) = P(A | B)P(B) / (P(A | B)P(B) +P(A | Bc)P(Bc))**
* pBGAc = pAcGB \* pB/(pAcGB \* pB + pAcGBc \* pBc) pBGAc = .5
* Let X1,…,Xn1 be random variables independent of Y1,…,Yn2, where both groups are iid with associated population means μ1 and μ2 and population variances σ21 and σ22, respectively. Let X¯ and Y¯ be their sample means. What is the variance of X¯−Y¯?
* variance of  X−Y = cov(X−Y,X−Y) = cov(X,X) + cov(Y,Y) − 2cov(X,Y)
* which follows from bilinearity of covariance. Therefore, 
* when X,YX,Y are independent the covariance is 0  🡺 
* Quality control experts estimate that time (in years) until a specific electronic part from an assembly line fails follows (a specific instance of) the Pareto density, f(x)=3x4 for 1<x<∞. Which option is closest to the mean failure time?
*  🡺 years
* Let f be a continuous density having a finite mean and μ be any number. Suppose that f(x)=f(−x) (i.e. f is symmetric about 0). Convince yourself that f(x−μ) is a valid density. What is its associated mean?
* **μ**
* It can't be ascertained.
* 1
* Suppose that f be a mean 0 density having variance 1. What is the variance associated with the density g(x)=f(x/σ)/σ?
* **σ2**
* **??** Plug in z for 1/**σ 🡪 integrate z(f(zx)) 🡺 pull and square constant z == z^3(f(x)) == z^3\***
* If X and Y are mean 0, variance 1 independent random variables, what is E[X2Y2]?
* **1??**