Formulas For Math 447

Part A. Fill the blanks of the formulas (30 points)

1. DeMorgan's laws: $\overline{(A \cap B)} = \underline{\overline{A} \cup \overline{B}}$, and $\overline{(A \cup B)} = \underline{\overline{A} \cap \overline{B}}$.
2. Axioms of probability: (1) $P(A) \geq \underline{0}$, (2) $P(S) = \underline{1}$,
   (3) if A_i's are pairwise $\underline{disjoint}$, then $P(\cup_i A_i) = \sum_i P(A_i)$.
3. If each sample point in the sample space S is equally likely to occur, $P(A) = \frac{N(_____)}{N(_____)}$ **key:** $\underline{A}$, $\underline{S}$
4. If an experiment can be partitioned into 2 steps, with n_i choices in the i^{th} step, then the total # of choices in the experiment is $\underline{n_1 n_2}$
5. $P_r^n = \frac{n!}{(n-r)!}$, $C_r^n = \binom{n}{r} = \frac{n!}{r!(n-r)!}$,
   $\binom{n}{n_1,n_2,n_3} = \frac{n!}{n_1!n_2!n_3!}$, where $n_1 + n_2 + n_3 = \underline{n}$
6. $P(A \cap B) = \underline{P(A|B)P(B)}$. If A and B are $\underline{independent}$ then $P(A \cap B) = P(A)P(B)$.
7. $P(\underline{\overline{A}}) = 1 - P(A)$. $P(A \cup B) = P(A) + P(B) \underline{-P(A \cap B)}$,
   If A and B are $\underline{disjoint}$ then $P(A \cup B) = \underline{P(A) + P(B)}$.
8. Bayes' Rule: If $\{B_1, ..., B_k\}$ is a partition of S and $P(A), P(B_j) > 0$, then
   $P(B_j|A) = \underline{\frac{P(A|B_j)P(B_j)}{\sum_{k=1}^{k} P(A|B_k)P(B_k)}}$
9. $X \sim bin(n,p)$: $f(i) = \underline{\binom{n}{i}p^i q^{n-i}}$, if $i \in \{0, ..., n\}$, $\mu = \underline{np}$, $\sigma^2 = \underline{npq}$ where $q = 1 - p$
10. $X \sim G(p)$. $f(i) = q^{i-1}p$ if $i \geq \underline{1}$, $\mu = \underline{1/p}$, $\sigma^2 = \underline{q/p^2}$
11. $X \sim Nbin(r,p)$, $f(i) = \binom{i-1}{r-1}p^r q^{i-r}$ if $i \geq \underline{r}$, $\mu = \underline{r/p}$, $\sigma^2 = \underline{rq/p^2}$
12. $X \sim HG(N,n,r)$. $f(i) = \underline{\frac{\binom{r}{i}\binom{N-r}{n-i}}{\binom{N}{n}}}$, $\mu = \underline{nr/N}$, $\underline{\sigma^2} = \frac{nr(N-r)(N-n)}{N^2(N-1)}$.
13. $X \sim Pois(\lambda)$. $f(i) = \underline{\frac{e^{-\lambda}\lambda^i}{i!}}$, if $i \geq 0$. $\mu = \underline{\lambda}$, $\sigma^2 = \underline{\lambda}$
14. Tchebysheff's Inequality. $P(|X - \mu| > k\sigma) \underline{\leq 1/k^2}$
15. $Y = g(X)$. $E(g(X)) = \begin{cases} \sum_y y f_Y(y) & \text{dis} \\ \int y f_Y(y) dy & \text{cts} \end{cases} = \underline{\begin{cases} \sum_x g(x) f_X(x) & \text{dis} \\ \int g(x) f_X(x) dx & \text{cts} \end{cases}}$, $\mu_Y = \underline{E(Y)}$,
    $\sigma_Y^2 = \underline{E(Y^2) - \mu_Y^2}$
16. The mgf of X is $M(t) = \underline{E(e^{Xt})}$, $\underline{\frac{d^k M(t)}{dt^k}\big|_{t=0}} = \underline{E(X^k)}$
17. A cdf $F(t)$ $(= \underline{P(X \leq t)},)$ satisfying (1) $F(-\infty) = \underline{0}$, and $F(\infty) = \underline{1}$, (2) $F(x+) = \underline{F(x)}$,
    (3) $F(x) \underline{\uparrow}$. Moreover, $\underline{F(b) - F(a) = \mathrm{P}(a < X \leq b)}$
18. $F(t) = \begin{cases} \sum_{x \leq t} \underline{f(x)} & \text{dis} \\ \underline{\int_{-\infty}^{t} f(x)dx} & \text{cts} \end{cases}$, $f(t) = \begin{cases} \underline{F(t) - F(t-)} & \text{dis} \\ \underline{F'(t)} & \text{cts} \end{cases}$
19. For discrete r.v. X, the p.f. f satisfies $f(t) = P(\underline{X = t})$, $f(t) \in \underline{[0,1]}$, and $\sum_t f(t) = \underline{1}$,
    For cts r.v. X, the d.f. f satisfies $f(t) \underline{\geq 0}$, and $\int f(t)dx = \underline{1}$
20. $E(aX + b) = \underline{aE(X) + b}$, $Var(aX + b) = \underline{a^2\sigma_X^2}$
21. $X \sim U(a,b)$. $f(x) = \underline{\frac{1}{b-a}}$, if $x \in (a,b)$. $\mu = \underline{\frac{a+b}{2}}$, $\sigma^2 = \underline{\frac{(b-a)^2}{12}}$
22. $X \sim N(\mu, \sigma^2)$. $f(x) = \underline{\frac{1}{\sqrt{2\pi\sigma^2}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}}$, $\frac{X-\mu}{\sigma} \sim \underline{N(0,1)}$
23. $X \sim \mathcal{G}(\alpha, \beta)$. $f(x) = \underline{\frac{x^{\alpha-1}e^{-x/\beta}}{\Gamma(\alpha)\beta^\alpha}}$, if $x > \underline{0}$, $\mu = \underline{\alpha\beta}$, $\sigma^2 = \underline{\alpha\beta^2}$, $\Gamma(\alpha+1) = \underline{\alpha\Gamma(\alpha)}$
24. $Exp(\lambda) = \underline{\mathcal{G}(1,\lambda)}$, $\chi^2(\nu) = \underline{\mathcal{G}(\frac{\nu}{2}, 2)}$

25. $X \sim beta(\alpha, \beta)$. $f(x) = \underline{\frac{x^{\alpha-1}(1-x)^{\beta-1}}{B(\alpha,\beta)}}$, if $x \in \underline{(0,1)}$, $\mu = \underline{\frac{\alpha}{\alpha+\beta}}$, where $B(\alpha,\beta) = \underline{\frac{\Gamma(\alpha)\Gamma(\beta)}{\Gamma(\alpha+\beta)}}$
26. The cdf of (X,Y) is $F(x,y) = P(\underline{X \le x, Y \le y}) = \begin{cases} \underline{\int_{-\infty}^{x}\int_{-\infty}^{y} f(t,s)dsdt} & \text{cts} \\ \underline{\sum_{t\le x}\sum_{s\le y} f(t,s)} & \text{dis} \end{cases}$
27. For continuous (X,Y), their d.f. $f(x,y) = \underline{\frac{\partial^2 F(x,y)}{\partial x \partial y}}$, $f(x,y) \ge \underline{0}$, $\int\int f(x,y)dxdy = \underline{1}$,
For discrete (X,Y), their d.f. $f(x,y) = \underline{P\{X=x, Y=y\}}$, $f(x,y) \in \underline{[0,1]}$,
$\sum_x \sum_y f(x,y) = \underline{1}$
28. $P((X,Y) \in A) = \begin{cases} \underline{\int\int_{(x,y)\in A} f(x,y)dxdy} & \text{cts} \\ \underline{\sum_{(x,y)\in A} f(x,y)} & \text{dis} \end{cases}$
29. $f_X(x) = \begin{cases} \int f(x,y)\underline{dy} & \text{cts} \\ \underline{\sum_y f(x,y)} & \text{dis} \end{cases}$
30. $f_{X|Y}(x|y) = \underline{\frac{f(x,y)}{f_Y(y)}}$, $F_{X|Y}(x|y) = P\ (\underline{X \le x | Y = y})$
31. $E(g(X,Y)) = \begin{cases} \underline{\int\int g(x,y)f(x,y)dxdy} & \text{cts} \\ \underline{\sum_x \sum_y g(x,y)f(x,y)} & \text{dis} \end{cases}$
32. The cts or discrete X and Y are independent iff $F(x,y) = \underline{F_X(x)F_Y(y)}$ iff $f(x,y) = \underline{f_X(x)f_Y(y)}$
33. $\underline{E(c) = c}$, $\underline{E(ag(X,Y) + bh(X,Y)) = aE(g(X,Y)) + bE(h(X,Y))}$
34. $Cov(X,Y) = \underline{E(XY) - E(X)E(Y)}$, $\underline{V(aX+bY) = a^2V(X) + b^2V(Y) + 2abCov(X,Y)}$, $\rho = \underline{\frac{Cov(X,Y)}{\sigma_X \sigma_Y}}$,
35. $(Y_1, Y_2, ..., Y_k) \sim M(n, p_1, ..., p_k)$. $f(y_1, ..., y_k) = \underline{\binom{n}{y_1,...,y_k}}\ p_1^{y_1} \cdots p_k^{y_k}$, $y_i \in \{0, 1, ..., n\}$, $\sum_i p_i = \underline{1}$, and $\sum_i y_i = \underline{n}$, $Cov(Y_i, Y_j) = \underline{-np_ip_j}$, if $\underline{i \ne j}$, $\underline{Y_i \sim bin(n, p_i)}$
36. $E(X|Y=y) = \begin{cases} \underline{\int x f(x|y)dx} & \text{cts} \\ \underline{\sum_x x f(x|y)} & \text{dis} \end{cases}$. $E(E(X|Y)) = \underline{E(X)}$,
$E(V(X|Y)) + V(E(X|Y)) = \underline{V(X)}$
37. $U = h(Y_1, ..., Y_n)$, where Y_i's are continuous. $F_U(t) = \int \cdots \int_A f(y_1, ..., y_n)dy_1 \cdots dy_n$, where $A = \underline{\{h(y_1, ..., y_n) \le t\}}$, $f_U(t) = \underline{F_U'(t)}$
38. $U = h(Y)$, where h is $\underline{monotone}$, and Y is cts. $f_U(u) = f_Y(\ \underline{h^{-1}(u)}\ ) \cdot \underline{\left|\frac{\partial h^{-1}}{\partial u}\right|}$
39. If X and Y are independent, then $Cov(X,Y) = \underline{0}$, $E(g(X)h(Y)) = \underline{E(g(X))E(h(Y))}$
$M_{X+Y}(t) = \underline{M_X(t) \cdot M_Y(t)}$
Hereafter, let Y_1, ..., Y_n be a random sample of Y.
40. Let Y_1, ..., Y_n be a random sample of Y. $\overline{Y} = \underline{\frac{1}{n}\sum_{i=1}^n Y_i}$, $S^2 = S_Y^2 = \underline{\frac{1}{n-1}\sum_{i=1}^n (Y_i - \overline{Y})^2}$
41. If $Y \sim N(\mu, \sigma^2)$, $\frac{\overline{Y} - \mu_{\overline{Y}}}{\sigma_{\overline{Y}}} \sim \underline{N(0,1)}$, $\underline{\frac{(n-1)S^2}{\sigma^2} \sim \chi^2(n-1)}$, $\sqrt{n}\frac{\overline{Y}-\mu}{S} \sim \underline{t_{n-1}}$, where $\mu_{\overline{Y}} = \underline{\mu}$, $\sigma_{\overline{Y}}^2 = \underline{\sigma^2/n}$
42. $F_{\overline{Y}}(t) \approxeq \Phi(\ \underline{\frac{t-\mu_{\overline{Y}}}{\sigma_{\overline{Y}}}}\ )$, where $\Phi(t)$ is the cdf of $\underline{N(0,1)}$

Review formulas for Math 448,

1. Estimator of μ is $\overline{X}$ where $\overline{X} =$ _____, Estimator of σ^2 is S^2, where $S^2 =$ _____, **key:** $\underline{\sum_i X_i/n}$, $\underline{\frac{1}{n-1}\sum_{i=1}^n (X_i - \overline{X})^2}$.
2. An estimator $\hat{\theta}$ is unbiased if _____, bias $B(\hat{\theta}) =$ _____, MSE = _____, (**key:** $\underline{E(\hat{\theta}) = \theta}$, $\underline{E(\hat{\theta}) - \theta}$, $\underline{V(\hat{\theta}) + (B(\hat{\theta}))^2}$,
3. $100(1-\alpha)\%$ CI for θ: _____ = _____ **key:** $\underline{P(a \le \theta \le b)}$, $\underline{1-\alpha}$.
4. $100(1-\alpha)\%$ large sample CI for θ: _____ **key:** $\underline{\hat{\theta} \pm z_{\alpha/2}\hat{\sigma}_{\hat{\theta}}}$.
5. If (1) X_1, ..., X_n are i.i.d. from $N(\mu_x, __)$, (2) Y_1, ..., Y_m are i.i.d. from $N(\mu_y, __)$, and (3) X_i's ___ Y_j's, then $T = \underline{\frac{\overline{X}-\mu_x}{S_x/\sqrt{n}}}$, $\sim$ _____,

   $T = \frac{\overline{X}-\overline{Y}-(\mu_x-\mu_y)}{\hat{\sigma}_p\sqrt{1/n+1/m}} \sim$ _____, where $\hat{\sigma} =$ _____,

   $W = (n-1)S_x^2/\sigma^2 \sim$ _____, $F = S_x^2/S_y^2 \sim$ _____,

   key: $\underline{\sigma^2}$, $\underline{\sigma^2}$, $\underline{\perp}$, $\underline{t_{n-1}}$, $\underline{t_{n+m-2}}$, $\underline{\sqrt{\frac{(n-1)S_x^2+(m-1)S_y^2}{n+m-2}}}$, $\underline{\chi^2_{n-1}}$, $\underline{F_{n-1,m-1}}$,
6. $f_{Y_{(j)}}(t) = \binom{n}{j-1,1,n-j}$ _____ **key:** $\underline{(F(t))^{j-1}(f(t))^1(1-F(t))^{n-j}}$.
7. Given two _____ estimators $\hat{\theta}_1$ and $\hat{\theta}_2$, $\text{eff}(\hat{\theta}_1, \hat{\theta}_2) =$ _____,

   key: $\underline{unbiased}$, $\underline{\frac{V(\hat{\theta}_2)}{V(\hat{\theta}_1)}}$,
8. $\hat{\theta}$ is consistent or $\hat{\theta} \xrightarrow{P} \theta$ if $P(|\hat{\theta} - \theta| > \epsilon) \to$ _____, _____ > 0, **key:** $\underline{0}$, $\underline{\forall \ \epsilon}$,
9. If (1) $E(\hat{\theta}) =$ _____ and (2) $V(\hat{\theta})$ _____, as $n \to \infty$, then $\hat{\theta}$ is consistent.

   key: $\underline{\theta}$, $\underline{\to 0}$,
10. If $g(\cdot)$ is _____, $\hat{\theta}_1 \xrightarrow{P} \theta_1$ and $\hat{\theta}_2 \xrightarrow{P} \theta_2$,

    then $\hat{\theta}_1 \pm \hat{\theta}_2 \xrightarrow{P}$ _____, $\hat{\theta}_1\hat{\theta}_2 \xrightarrow{P}$ _____, $g(\hat{\theta}_1) \xrightarrow{P}$ _____,

    key: $\underline{cts}$, $\underline{\theta_1 \pm \theta_2}$, $\underline{\theta_1\theta_2}$, $\underline{g(\theta_1)}$,
11. If $X_1, ..., X_n$ are i.i.d. from $f(x;\theta) = exp\{$_____ $+ g(\theta) + h(x)\}$, $\hat{\gamma} = G($_____$)$ and _____ $= \gamma(\theta)$, then $\hat{\gamma}$ is the MVUE of γ.

    key: $\underline{T(x)\psi(\theta)}$, $\underline{\sum_i T(X_i))}$, $\underline{E(\hat{\gamma})}$,
12. An MME of θ, is the solution of θ to $\mu_i'(\theta) =$ _____ for k i's, where $\mu_i'(\theta) =$ _____, and k is the dimension of θ. **key:** $\underline{\overline{X^i}}$, $\underline{E(X^i)}$,
13. Given a random sample X_1, ..., X_n from $f(x;\theta)$, their likelihood is $L(\theta) =$ _____, the MLE $\hat{\theta}$ of θ maximizes _____. If $g(\theta)$ is a _____ function of θ, the MLE of $g(\theta)$ is _____.

    key: $\underline{\prod_i f(X_i;\theta)}$, $\underline{L(\theta)}$. $\underline{1-1}$, $\underline{g(\hat{\theta})}$,
14. Given a random sample from $f(x;\theta)$, and a function $g(\theta)$, under certain conditions, $P(g(\hat{\theta}) \le t)$ ____ $\Phi(\frac{t-g(\theta)}{\hat{\sigma}_{g(\hat{\theta})}})$, where $\hat{\theta}$ is the _____ of θ, $\hat{\sigma}_{g(\hat{\theta})} =$ _____

    key: $\underline{\approx}$, $\underline{MLE}$, $\underline{\sqrt{\left\{(\frac{\partial g}{\partial \theta})^2/(-nE(\frac{\partial^2 \log f(X;\theta)}{\partial \theta^2}))\right\}\Big|_{\theta=\hat{\theta}}}}$,
15. The 5 elements of a test are (1) _____, (2) _____, (3) test statistics (4) _____, (5) _____, **key:** $\underline{H_o}$, $\underline{H_a}$, $\underline{RR}$, $\underline{Conclusion}$,
16. Probability of type I error is _____, Probability of type II error is _____, **key:** $\underline{P(H_a|H_o)}$, $\underline{P(H_o|H_a)}$,
17. For a large sample test for H_o: $\theta = \theta_o$, a test statistic is $Z =$ _____, a RR is Z_____ if $\theta > \theta_o$; and a RR is _____ if $\theta \ne \theta_o$; **key:** $\underline{\frac{\hat{\theta}-\theta_o}{\hat{\sigma}_{\hat{\theta}}}}$, $\underline{> z_\alpha}$, $\underline{|Z| > z_{\alpha/2}}$,

18. Sample size for an upper-tail α-level test is $n = (_____)^2$ **key:** $\frac{(z_\alpha + z_\beta)\sigma}{\mu_a - \mu_o}$,

19. The P-value is $\begin{cases} P(W ____ w)|H_o \text{ is correct}) & \text{if } H_a: \ \theta > \theta_o \\ P(W ____ w)|H_o \text{ is correct}) & \text{if } H_a: \ \theta < \theta_o \\ __P(W ____ |w|)|H_o \text{ is correct}) & \text{if } H_a: \ \theta \neq \theta_o \end{cases}$ where W is the (Z or T) test statistic and w is the observed value of W. **key:** $\geq$, $\leq$, $\underline{2}$, $\geq$,

20. Suppose that $Z \sim N(0,1)$, $X \sim \chi^2(u)$, $Y \sim \chi^2(v)$. If Z____X, $T =$ _____, then $T \sim t_u$; If X____Y, $F =$ ____, then $F \sim F_{u,v}$ and $X + Y \sim$ _____. **key:** $\perp\!\!\!\perp$, $\underline{Z/\sqrt{X/u}}$, $\perp\!\!\!\perp$, $\underline{\frac{X/u}{Y/v}}$, $\underline{\chi^2(u+v)}$,

21. The MP test for H_o: $\theta = \theta_o$ v.s. H_a: $\theta = \theta_a$, the MP test has the RR satisfying: $\frac{L(\theta_o)}{L(\theta_a)}$____$k$ and $P_\theta(RR) = \alpha$ if $\theta =$ ____. **key:** $\underline{\leq}$, $\underline{\theta_o}$,

22. The Likelihood ratio test for H_o: $\theta \in \Theta_o$ v.s. H_a: $\theta \notin \Theta_o$ has a RR: $\{\lambda$____$k\}$, where

    $\lambda =$ _____; $\hat{\theta}_o$ is the MLE under ____; $\hat{\theta}$ is the MLE under ____;

    k satisfies $max\{P(RR): \ \theta \in \Theta_o\} =$ ____; if n is large, then $-2\ln\lambda$ is approximated _____; where $v =$ _____; r and $r_o = \#$ of free parameters in Θ and in Θ_o, respectively.

    key: $\underline{\leq}$, $\underline{\frac{L(\hat{\theta}_o)}{L(\hat{\theta})}}$, $\underline{\Theta_o}$, $\underline{\Theta}$, $\underline{\alpha}$, $\underline{\chi^2(v)}$, $\underline{r - r_o}$

23. Suppose (x_i, Y_i)'s are independent, $\mu_{x_i}(\theta) = E(Y_i)$, the LSE of θ, denoted by $\hat{\theta}$, minimizes _____.

    If $\mu_{x_i}(\theta) = \beta_0 + \beta_1 x_i$ and $V(Y_i) = \sigma^2$, the LSE $\hat{\beta}_0 =$ _____,

    $\hat{\beta}_1 =$ _____, $S_{xy} =$ _____, $E(\hat{\beta}_0) =$ _____, $E(\hat{\beta}_1) =$ _____,

    $\sigma^2_{\hat{\beta}_0} =$ _____, $\sigma^2_{\hat{\beta}_1} =$ _____, an unbiased estimator of σ^2 is $\hat{\sigma}^2$=_____,

    key: $\underline{\sum_{i=1}^n [Y_i - \mu_{x_i}(\theta)]^2}$, $\underline{\overline{Y} - \hat{\beta}_1 \overline{x}}$, $\underline{S_{xy}/S_{xx}}$, $\underline{n(\overline{xY} - \overline{x}\overline{Y})}$, $\underline{\beta_0}$, $\underline{\beta_1}$,

    $\underline{\sigma^2 \overline{x^2}/S_{xx}}$, $\underline{\sigma^2/S_{xx}}$, $\underline{\frac{1}{n-2}(S_{yy} - \hat{\beta}_1 S_{xy})}$,

    If $Y_i \sim$ _____, then $\hat{\beta}_j \sim$ _____, $\frac{n-2}{\sigma^2}\hat{\sigma}^2 \sim$ _____, $\hat{\sigma}^2, \hat{\beta}_0, \hat{\beta}_1$ are _____, _____ $\sim t_{n-2}$,

    key: $\underline{N(\beta_0 + \beta_1 x_i, \sigma^2)}$, $\underline{N(\beta_j, \sigma^2_{\hat{\beta}_j})}$, $\underline{\chi^2(n-2)}$, $\underline{independent}$, $\underline{\frac{\hat{\beta}_j - \beta_j}{\hat{\sigma}_{\hat{\beta}_j}}}$,

24. Under the Bayes model, conditional on θ, Y_1, ..., Y_n are i.i.d. with $f(y|\theta)$, and $\theta \sim g(\theta)$. The posterior df is $g(\theta|\underline{y}) =$ _____, where $\underline{y} = (y_1, ..., y_n)$ the Bayes estimator of $h(\theta)$ is $\hat{h} =$ _____

key: $\frac{\prod_{i=1}^n f(y_i|\theta)g(\theta)}{f_{\underline{Y}}(\underline{y})}$, $E(h(\theta)|\underline{y}))$,

Formulas for 447:

23. $X \sim \mathcal{G}(\alpha, \beta)$. $f(x) =$ _____ if $x >$ ____, $\mu =$ _____, $\sigma^2 =$ _____, $\Gamma(\alpha+1) =$ _____, **key:** $\frac{x^{\alpha-1}e^{-x/\beta}}{\Gamma(\alpha)\beta^\alpha}$, 0, $\alpha\beta$, $\alpha\beta^2$, $\alpha\Gamma(\alpha)$

24. $Exp(\lambda) =$ _____, $\chi^2(\nu) =$ _____, **key:** $\mathcal{G}(1, \lambda)$, $\mathcal{G}(\frac{\nu}{2}, 2)$

25. $X \sim beta(\alpha, \beta)$. $f(x) =$ _____ if x _____, $\mu =$ _____, where $B(\alpha, \beta) =$ _____,

key: $\frac{x^{\alpha-1}(1-x)^{\beta-1}}{B(\alpha,\beta)}$, $\in (0, 1)$, $\frac{\alpha}{\alpha+\beta}$, $\frac{\Gamma(\alpha)\Gamma(\beta)}{\Gamma(\alpha+\beta)}$

41. If Y_i's are i.i.d. with $N(\mu, \sigma^2)$, then $\frac{\overline{Y}-\mu_{\overline{Y}}}{\sigma_{\overline{Y}}} \sim$ _____, $\frac{(n-1)S^2}{\sigma^2} \sim$ _____, S^2 ____ $\overline{Y}$, where $\mu_{\overline{Y}} =$ _____, $\sigma^2_{\overline{Y}} =$ _____ **key:** $N(0,1)$, $\chi^2(n-1)$, $\perp$, μ, σ^2/n

44. If X_1___X_2.

X_i's $\sim$:	$X_1 + X_2 \sim$:
$\mathcal{G}(\alpha_i, \beta)$	$\mathcal{G}(\alpha_1 + \alpha_2, \beta)$
$\chi^2(v_i)$	$\chi^2(v_1 + v_2)$
$Pois(\lambda_i)$	$Pois(\lambda_1 + \lambda_2)$
$N(\mu_i, \sigma_i^2)$	$N(\mu_x + \mu_y, \sigma_1^2 + \sigma_2^2)$
$bin(n_i, p)$	$bin(n_1 + n_2, p)$

key: $\perp$,