

FALL 2016
HUNTER COLLEGE
STAT 213 Section 06/HC1
Introduction to Applied Statistics
Midterm Exam Two

Last Name: _____

First Name: _____

Graduation Year: _____

December 5, 2016

1. Please do not leave blank for any question.
2. There are 7 questions, each question is 6 points. A perfect score is 42 points.
3. You have 70 minutes for this exam (4:15 pm - 5:25 pm).
4. Explain briefly = Explain in one sentence or several phrases.

Formulas

$$\sum_{i=1}^n x_i = x_1 + x_2 + \cdots + x_n$$

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

$$z = \frac{x - \mu}{\sigma}$$

$$x = \mu + \sigma z$$

$$s_x^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}$$

$$s_x = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$$

$$\Pr(|X - \mu| \leq k\sigma) \geq 1 - \frac{1}{k^2}, \text{ for any distribution}$$

$\Pr(|X - \mu| \leq \sigma) \approx 0.68$, $\Pr(|X - \mu| \leq 2\sigma) \approx 0.95$, $\Pr(|X - \mu| \leq 3\sigma) \approx 0.997$, for normal distribution

$$r = \frac{1}{n-1} \sum_{i=1}^n \left(\frac{x_i - \bar{x}}{s_x} \right) \left(\frac{y_i - \bar{y}}{s_y} \right)$$

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{(n-1)s_x s_y}$$

$$\hat{y} = a + bx$$

$$b = r \frac{s_y}{s_x}$$

$$b = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2}$$

$$a = \bar{y} - b\bar{x}$$

$$SSTo = \sum_{i=1}^n (y_i - \bar{y})^2, SSTo = \sum_{i=1}^n y_i^2 - n\bar{y}^2$$

$$SSResid = \sum_{i=1}^n (y_i - \hat{y}_i)^2, SSResid = \sum_{i=1}^n y_i^2 - a \sum_{i=1}^n y_i - b \sum_{i=1}^n x_i y_i$$

$$r^2 = 1 - \frac{SSResid}{SSTo}$$

$$s_e = \sqrt{\frac{SSResid}{n-2}}$$

If events E_1, \dots, E_k are all mutually exclusive, then $\Pr(E_1 \cup \dots \cup E_k) = \Pr(E_1) + \dots + \Pr(E_k)$

$$\Pr(E | F) = \frac{\Pr(E \cap F)}{\Pr(F)}$$

The event E and F are independent if and only if $\Pr(E \cap F) = \Pr(E) \Pr(F)$

$$\Pr(E \cup F) = \Pr(E) + \Pr(F) - \Pr(E \cap F)$$

$$\Pr(E \cap F) = \Pr(E|F) \Pr(F) = \Pr(F|E) \Pr(E)$$

If events B_1, \dots, B_k are all mutually exclusive with $\Pr(B_1) + \dots + \Pr(B_k) = 1$, then for any event E , $\Pr(E) = \Pr(E | B_1) \Pr(B_1) + \dots + \Pr(E | B_k) \Pr(B_k)$

If events B_1, \dots, B_k are all mutually exclusive with $\Pr(B_1) + \dots + \Pr(B_k) = 1$, then for any event E , $\Pr(B_i | E) = \frac{\Pr(E|B_i)\Pr(B_i)}{\Pr(E|B_1)\Pr(B_1) + \dots + \Pr(E|B_k)\Pr(B_k)}$

For continuous random variable X , $\Pr(a < X \leq b) = \Pr(X \leq b) - \Pr(X \leq a)$

Mean value of a discrete random variable $\mu_X = \sum x \cdot p(x)$

Standard deviation of a discrete random variable $\sigma_X = \sqrt{\sum (x - \mu_X)^2 \cdot p(x)}$

$Y = a + bX$. Mean $\mu_Y = a + b\mu_X$. Standard deviation $\sigma_Y = |b|\sigma_X$

$Y = a_1X_1 + \dots + a_nX_n$. Mean $\mu_Y = a_1\mu_{X_1} + \dots + a_n\mu_{X_n}$. Standard deviation (when X_i 's are independent) $\sigma_Y = \sqrt{a_1^2\sigma_{X_1}^2 + \dots + a_n^2\sigma_{X_n}^2}$

Binomial distribution $p(x) = \frac{n!}{x!(n-x)!}p^x(1-p)^{n-x}$, $\mu_X = np$, $\sigma_X = \sqrt{np(1-p)}$

Geometric distribution $p(x) = (1-p)^{x-1}p$, $\mu_X = 1/p$

Continuity correction (X is a discrete variable (integer values), Y is the corresponding Normal random variable): If $\Pr(X \leq m)$ use $\Pr(Y < m + 0.5)$; If $\Pr(X < m)$ use $\Pr(Y < m - 0.5)$

Sampling distribution of \bar{X} : $\mu_{\bar{X}} = \mu$, $\sigma_{\bar{X}} = \sigma/\sqrt{n}$

Sampling distribution of \hat{p} : $\mu_{\hat{p}} = p$, $\sigma_{\hat{p}} = \sqrt{p(1-p)/n}$

$(1 - \alpha) \times 100\%$ confidence interval for p : $\hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$n = p(1-p) \left(\frac{z_{\alpha/2}}{B} \right)^2$

$(1 - \alpha) \times 100\%$ confidence interval for μ : $\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

$n = \left(\frac{z_{\alpha/2}\sigma}{B} \right)^2$

$(1 - \alpha) \times 100\%$ confidence interval for μ : $\bar{x} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$

Finite population correction factor: $\sqrt{\frac{N-n}{N-1}}$

$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$, where μ is the hypothesized value under H_0

$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$, where μ is the hypothesized value under H_0

Power + Type II error = 1

Paired two-sample t -test: $t = \frac{\bar{x}_d - \text{hypothesized value}}{s_d/\sqrt{n}}$, $d.f. = n - 1$

Independent two-sample t -test: $t = \frac{\bar{x}_1 - \bar{x}_2 - \text{hypothesized value}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$, $d.f. = \left\lfloor \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} \right)^2}{\frac{\left(\frac{s_1^2}{n_1} \right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2} \right)^2}{n_2 - 1}} \right\rfloor$

Hypothesis Test concerning slope β : $t = \frac{b - \text{hypothesized value}}{s_\beta}$, where $s_\beta = \frac{s_e}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2}}$ and $d.f. = n - 2$.

STUDENT'S t PERCENTAGE POINTS

| | | | | | | | | | | | |
|-------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| one-tail | 40.0% | 33.3% | 25.0% | 20.0% | 12.5% | 10.0% | 5.0% | 2.5% | 1.0% | 0.5% | 0.1% |
| two-tail | 80.0% | 66.7% | 50.0% | 40.0% | 25.0% | 20.0% | 10.0% | 5.0% | 2.0% | 1.0% | 0.2% |
| cum. prob | 60.0% | 66.7% | 75.0% | 80.0% | 87.5% | 90.0% | 95.0% | 97.5% | 99.0% | 99.5% | 99.9% |
| 1 | 0.325 | 0.577 | 1.000 | 1.376 | 2.414 | 3.078 | 6.314 | 12.706 | 31.821 | 63.657 | 318.31 |
| 2 | 0.289 | 0.500 | 0.816 | 1.061 | 1.604 | 1.886 | 2.920 | 4.303 | 6.965 | 9.925 | 22.327 |
| 3 | 0.277 | 0.476 | 0.765 | 0.978 | 1.423 | 1.638 | 2.353 | 3.182 | 4.541 | 5.841 | 10.215 |
| 4 | 0.271 | 0.464 | 0.741 | 0.941 | 1.344 | 1.533 | 2.132 | 2.776 | 3.747 | 4.604 | 7.173 |
| 5 | 0.267 | 0.457 | 0.727 | 0.920 | 1.301 | 1.476 | 2.015 | 2.571 | 3.365 | 4.032 | 5.893 |
| 6 | 0.265 | 0.453 | 0.718 | 0.906 | 1.273 | 1.440 | 1.943 | 2.447 | 3.143 | 3.707 | 5.208 |
| 7 | 0.263 | 0.449 | 0.711 | 0.896 | 1.254 | 1.415 | 1.895 | 2.365 | 2.998 | 3.499 | 4.785 |
| 8 | 0.262 | 0.447 | 0.706 | 0.889 | 1.240 | 1.397 | 1.860 | 2.306 | 2.896 | 3.355 | 4.501 |
| 9 | 0.261 | 0.445 | 0.703 | 0.883 | 1.230 | 1.383 | 1.833 | 2.262 | 2.821 | 3.250 | 4.297 |
| 10 | 0.260 | 0.444 | 0.700 | 0.879 | 1.221 | 1.372 | 1.812 | 2.228 | 2.764 | 3.169 | 4.144 |
| 11 | 0.260 | 0.443 | 0.697 | 0.876 | 1.214 | 1.363 | 1.796 | 2.201 | 2.718 | 3.106 | 4.025 |
| 12 | 0.259 | 0.442 | 0.695 | 0.873 | 1.209 | 1.356 | 1.782 | 2.179 | 2.681 | 3.055 | 3.930 |
| 13 | 0.259 | 0.441 | 0.694 | 0.870 | 1.204 | 1.350 | 1.771 | 2.160 | 2.650 | 3.012 | 3.852 |
| 14 | 0.258 | 0.440 | 0.692 | 0.868 | 1.200 | 1.345 | 1.761 | 2.145 | 2.624 | 2.977 | 3.787 |
| 15 | 0.258 | 0.439 | 0.691 | 0.866 | 1.197 | 1.341 | 1.753 | 2.131 | 2.602 | 2.947 | 3.733 |
| 16 | 0.258 | 0.439 | 0.690 | 0.865 | 1.194 | 1.337 | 1.746 | 2.120 | 2.583 | 2.921 | 3.686 |
| 17 | 0.257 | 0.438 | 0.689 | 0.863 | 1.191 | 1.333 | 1.740 | 2.110 | 2.567 | 2.898 | 3.646 |
| 18 | 0.257 | 0.438 | 0.688 | 0.862 | 1.189 | 1.330 | 1.734 | 2.101 | 2.552 | 2.878 | 3.610 |
| 19 | 0.257 | 0.438 | 0.688 | 0.861 | 1.187 | 1.328 | 1.729 | 2.093 | 2.539 | 2.861 | 3.579 |
| 20 | 0.257 | 0.437 | 0.687 | 0.860 | 1.185 | 1.325 | 1.725 | 2.086 | 2.528 | 2.845 | 3.552 |
| 21 | 0.257 | 0.437 | 0.686 | 0.859 | 1.183 | 1.323 | 1.721 | 2.080 | 2.518 | 2.831 | 3.527 |
| 22 | 0.256 | 0.437 | 0.686 | 0.858 | 1.182 | 1.321 | 1.717 | 2.074 | 2.508 | 2.819 | 3.505 |
| 23 | 0.256 | 0.436 | 0.685 | 0.858 | 1.180 | 1.319 | 1.714 | 2.069 | 2.500 | 2.807 | 3.485 |
| 24 | 0.256 | 0.436 | 0.685 | 0.857 | 1.179 | 1.318 | 1.711 | 2.064 | 2.492 | 2.797 | 3.467 |
| 25 | 0.256 | 0.436 | 0.684 | 0.856 | 1.178 | 1.316 | 1.708 | 2.060 | 2.485 | 2.787 | 3.450 |
| 26 | 0.256 | 0.436 | 0.684 | 0.856 | 1.177 | 1.315 | 1.706 | 2.056 | 2.479 | 2.779 | 3.435 |
| 27 | 0.256 | 0.435 | 0.684 | 0.855 | 1.176 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 | 3.421 |
| 28 | 0.256 | 0.435 | 0.683 | 0.855 | 1.175 | 1.313 | 1.701 | 2.048 | 2.467 | 2.763 | 3.408 |
| 29 | 0.256 | 0.435 | 0.683 | 0.854 | 1.174 | 1.311 | 1.699 | 2.045 | 2.462 | 2.756 | 3.396 |
| 30 | 0.256 | 0.435 | 0.683 | 0.854 | 1.173 | 1.310 | 1.697 | 2.042 | 2.457 | 2.750 | 3.385 |
| 35 | 0.255 | 0.434 | 0.682 | 0.852 | 1.170 | 1.306 | 1.690 | 2.030 | 2.438 | 2.724 | 3.340 |
| 40 | 0.255 | 0.434 | 0.681 | 0.851 | 1.167 | 1.303 | 1.684 | 2.021 | 2.423 | 2.704 | 3.307 |
| 45 | 0.255 | 0.434 | 0.680 | 0.850 | 1.165 | 1.301 | 1.679 | 2.014 | 2.412 | 2.690 | 3.281 |
| 50 | 0.255 | 0.433 | 0.679 | 0.849 | 1.164 | 1.299 | 1.676 | 2.009 | 2.403 | 2.678 | 3.261 |
| 55 | 0.255 | 0.433 | 0.679 | 0.848 | 1.163 | 1.297 | 1.673 | 2.004 | 2.396 | 2.668 | 3.245 |
| 60 | 0.254 | 0.433 | 0.679 | 0.848 | 1.162 | 1.296 | 1.671 | 2.000 | 2.390 | 2.660 | 3.232 |
| ∞ | 0.253 | 0.431 | 0.674 | 0.842 | 1.150 | 1.282 | 1.645 | 1.960 | 2.326 | 2.576 | 3.090 |
| conf. level | 20.0% | 33.3% | 50.0% | 60.0% | 75.0% | 80.0% | 90.0% | 95.0% | 98.0% | 99.0% | 99.8% |

NORMAL CUMULATIVE DISTRIBUTION FUNCTION

| z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0.0 | 0.5000 | 0.5040 | 0.5080 | 0.5120 | 0.5160 | 0.5199 | 0.5239 | 0.5279 | 0.5319 | 0.5359 |
| 0.1 | 0.5398 | 0.5438 | 0.5478 | 0.5517 | 0.5557 | 0.5596 | 0.5636 | 0.5675 | 0.5714 | 0.5753 |
| 0.2 | 0.5793 | 0.5832 | 0.5871 | 0.5910 | 0.5948 | 0.5987 | 0.6026 | 0.6064 | 0.6103 | 0.6141 |
| 0.3 | 0.6179 | 0.6217 | 0.6255 | 0.6293 | 0.6331 | 0.6368 | 0.6406 | 0.6443 | 0.6480 | 0.6517 |
| 0.4 | 0.6554 | 0.6591 | 0.6628 | 0.6664 | 0.6700 | 0.6736 | 0.6772 | 0.6808 | 0.6844 | 0.6879 |
| 0.5 | 0.6915 | 0.6950 | 0.6985 | 0.7019 | 0.7054 | 0.7088 | 0.7123 | 0.7157 | 0.7190 | 0.7224 |
| 0.6 | 0.7257 | 0.7291 | 0.7324 | 0.7357 | 0.7389 | 0.7422 | 0.7454 | 0.7486 | 0.7517 | 0.7549 |
| 0.7 | 0.7580 | 0.7611 | 0.7642 | 0.7673 | 0.7703 | 0.7734 | 0.7764 | 0.7794 | 0.7823 | 0.7852 |
| 0.8 | 0.7881 | 0.7910 | 0.7939 | 0.7967 | 0.7995 | 0.8023 | 0.8051 | 0.8078 | 0.8106 | 0.8133 |
| 0.9 | 0.8159 | 0.8186 | 0.8212 | 0.8238 | 0.8264 | 0.8289 | 0.8315 | 0.8340 | 0.8365 | 0.8389 |
| 1.0 | 0.8413 | 0.8438 | 0.8461 | 0.8485 | 0.8508 | 0.8531 | 0.8554 | 0.8577 | 0.8599 | 0.8621 |
| 1.1 | 0.8643 | 0.8665 | 0.8686 | 0.8708 | 0.8729 | 0.8749 | 0.8770 | 0.8790 | 0.8810 | 0.8830 |
| 1.2 | 0.8849 | 0.8869 | 0.8888 | 0.8907 | 0.8925 | 0.8944 | 0.8962 | 0.8980 | 0.8997 | 0.9015 |
| 1.3 | 0.9032 | 0.9049 | 0.9066 | 0.9082 | 0.9099 | 0.9115 | 0.9131 | 0.9147 | 0.9162 | 0.9177 |
| 1.4 | 0.9192 | 0.9207 | 0.9222 | 0.9236 | 0.9251 | 0.9265 | 0.9279 | 0.9292 | 0.9306 | 0.9319 |
| 1.5 | 0.9332 | 0.9345 | 0.9357 | 0.9370 | 0.9382 | 0.9394 | 0.9406 | 0.9418 | 0.9429 | 0.9441 |
| 1.6 | 0.9452 | 0.9463 | 0.9474 | 0.9484 | 0.9495 | 0.9505 | 0.9515 | 0.9525 | 0.9535 | 0.9545 |
| 1.7 | 0.9554 | 0.9564 | 0.9573 | 0.9582 | 0.9591 | 0.9599 | 0.9608 | 0.9616 | 0.9625 | 0.9633 |
| 1.8 | 0.9641 | 0.9649 | 0.9656 | 0.9664 | 0.9671 | 0.9678 | 0.9686 | 0.9693 | 0.9699 | 0.9706 |
| 1.9 | 0.9713 | 0.9719 | 0.9726 | 0.9732 | 0.9738 | 0.9744 | 0.9750 | 0.9756 | 0.9761 | 0.9767 |
| 2.0 | 0.9772 | 0.9778 | 0.9783 | 0.9788 | 0.9793 | 0.9798 | 0.9803 | 0.9808 | 0.9812 | 0.9817 |
| 2.1 | 0.9821 | 0.9826 | 0.9830 | 0.9834 | 0.9838 | 0.9842 | 0.9846 | 0.9850 | 0.9854 | 0.9857 |
| 2.2 | 0.9861 | 0.9864 | 0.9868 | 0.9871 | 0.9875 | 0.9878 | 0.9881 | 0.9884 | 0.9887 | 0.9890 |
| 2.3 | 0.9893 | 0.9896 | 0.9898 | 0.9901 | 0.9904 | 0.9906 | 0.9909 | 0.9911 | 0.9913 | 0.9916 |
| 2.4 | 0.9918 | 0.9920 | 0.9922 | 0.9925 | 0.9927 | 0.9929 | 0.9931 | 0.9932 | 0.9934 | 0.9936 |
| 2.5 | 0.9938 | 0.9940 | 0.9941 | 0.9943 | 0.9945 | 0.9946 | 0.9948 | 0.9949 | 0.9951 | 0.9952 |
| 2.6 | 0.9953 | 0.9955 | 0.9956 | 0.9957 | 0.9959 | 0.9960 | 0.9961 | 0.9962 | 0.9963 | 0.9964 |
| 2.7 | 0.9965 | 0.9966 | 0.9967 | 0.9968 | 0.9969 | 0.9970 | 0.9971 | 0.9972 | 0.9973 | 0.9974 |
| 2.8 | 0.9974 | 0.9975 | 0.9976 | 0.9977 | 0.9977 | 0.9978 | 0.9979 | 0.9979 | 0.9980 | 0.9981 |
| 2.9 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9984 | 0.9984 | 0.9985 | 0.9985 | 0.9986 | 0.9986 |
| 3.0 | 0.9987 | 0.9987 | 0.9987 | 0.9988 | 0.9988 | 0.9989 | 0.9989 | 0.9989 | 0.9990 | 0.9990 |
| 3.1 | 0.9990 | 0.9991 | 0.9991 | 0.9991 | 0.9992 | 0.9992 | 0.9992 | 0.9992 | 0.9993 | 0.9993 |
| 3.2 | 0.9993 | 0.9993 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9994 | 0.9995 | 0.9995 | 0.9995 |
| 3.3 | 0.9995 | 0.9995 | 0.9995 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9996 | 0.9997 |
| 3.4 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9997 | 0.9998 |
| 3.5 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 |
| 3.6 | 0.9998 | 0.9998 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.7 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.8 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.9 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

1. Bayes' Rule (Chapter 6)

At a certain gas station 50% of the customers request regular gas, 20% request plus gas, and 30% request premium gas. Of those customers requesting regular gas, 25% fill up their tanks. Of those customers requesting plus gas, 60% fill up their tanks, while of those requesting premium, 45% fill up their tanks. If the next customer fills up the tank, what is the probability that regular gas is requested?



Figure 1: Gas Price at Orlando FL, 2011-08-03

2. Discrete Random Variables (Chapter 7)

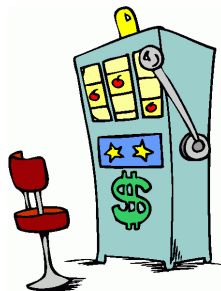
Suppose an individual plays a gambling game where it is possible to lose \$1.00, break even, win \$3.00, or win \$5.00 each time she plays. The probability distribution for each outcome is provided by the following table:

| | | | | |
|-------------|---------|--------|--------|--------|
| Outcome | -\$1.00 | \$0.00 | \$3.00 | \$5.00 |
| Probability | 0.30 | 0.40 | 0.20 | 0.10 |

- (1) Verify that the discrete probability distribution above is well-defined.
- (2) Find the mean and standard deviation of this discrete random variable.
- (3) Suppose that the casino decides that the game does not have an impressive enough top prize with the lower payouts, and decides to change the outcomes, as shown below

| | | | | |
|-------------|---------|---------|--------|--------|
| Outcome | -\$4.00 | -\$2.00 | \$4.00 | \$8.00 |
| Probability | 0.30 | 0.40 | 0.20 | 0.10 |

Find the relation between new outcome and previous outcomes. Based on the relation, find the mean and standard deviation of the new random variable.



3. Normal Distribution (Chapter 7)

(You may need a Normal Table for this question.)

Washington Police officers recorded the speeds of cars driving on a busy street by a school for a one-month period, where the speed limit read 20 mph. The mean of readings was 24.90 mph, with a standard deviation 7.52 mph.

(data source: www.wtsc.wa.gov)

What percent of the vehicles were exceeding the posted speed limit in school zones (20 mph)?

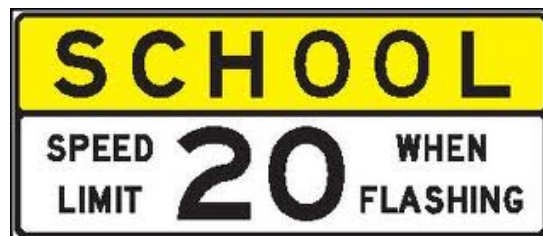


Figure 2: Speed limit 20 MPH.

4. Normal Probability Plot (Chapter 7)

Scientists found two new types of insects in Rocky Mountain, with sample size 4 and 5. For insect A, the body lengths (centimeter) are

1.2, 1.6, 2.4, 2.7,

for insect B, the body lengths (centimeter) are

0.8, 1.0, 1.1, 1.7, 3.1.

(1) Make Normal Probability Plots for insect A and insect B. You may put two sets of data on one plot with different symbols (for example, \circ and \times). (2) Check the normality based on your plots.

How to make a Normal Probability Plot

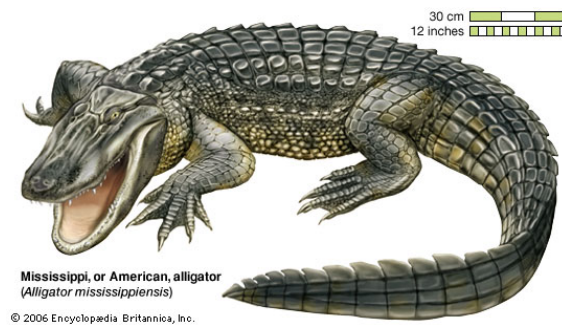
1. Sort the data. $x_1 \leq x_2 \leq \cdots \leq x_n$
2. Calculate the corresponding quantile

$$z_i = \Phi^{-1} \left(\frac{i - \frac{1}{2}}{n} \right)$$

3. Make a scatter plot for $\{z_i, x_i\}_{i=1}^n$.

5. Confidence Intervals (Chapter 8/9)

Biologists measured 8 American crocodiles (male, adult), the average length of this sample is 14.6 feet. The sample standard deviation of the lengths of American crocodiles (male, adult) is 0.74 feet. Find a 95% confidence interval of the mean length for all American crocodiles (male, adult). What is the margin of error?



6. Hypothesis Test (Chapter 10)

Mirex is a chlorinated hydrocarbon that was commercialized as an insecticide and later banned because of its impact on the environment.

Researchers tested 12 farm-raised salmon for organic contaminants. They found the mean concentration of the carcinogenic insecticide mirex to be 0.0913 parts per million, with sample standard deviation $s = 0.0195$ ppm. As a safety recommendation to recreational fishers, the Environmental Protection Agency's (EPA) recommended "screening value" for mirex is 0.08 ppm. Population distribution is assumed to be normal.

- (1) Is it necessary to use a finite population correction factor to adjust the standard error? Explain.
- (2) Are farmed salmon contaminated beyond the level permitted by the EPA? Use the significance level $\alpha = 0.05$.



7. Hypothesis Test (Chapter 11)

Do college students who have volunteered for community service work differ from those who have not? A study obtained data from 57 students who had done service work and 17 student who had not. One of the response variables was a measure of attachment to friends (roughly, secure relationships), measured by the the Inventory of Parent and Peer Attachment. Here are the results:

| Group | Condition | n | \bar{x} | s |
|-------|------------|-----|-----------|-------|
| 1 | Service | 57 | 105.32 | 10.68 |
| 2 | No service | 17 | 96.82 | 14.26 |

By using significance level 5%, choose the appropriate two-sample t -test to show whether college students who have volunteered for community service work differ from those who have not.

More Space

End of the Midterm 2 of Stat 213 Sec 06/HC1 (Instructor: Jiangtao Gou)