Norm distribution
Part 2

Problems. 5.1: 3abcdefg, 9ab, 10, 11a, 12, 13
5.2: 1abce, 4ab, 5, 8, 9, 17, 19

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5.1

3a) $P(X \le 10.34) = P\left(Z \le \frac{10.34 - 10}{\sqrt{2}}\right) = .5950$

b) $P(X \ge 11.98) = 1 - P\left(Z \le \frac{11.98 - 10}{\sqrt{2}}\right) = .0807$

c) $P(7.67 \le X \le 9.9) = \Phi\left(\frac{9.9 - 10}{\sqrt{2}}\right) - \Phi\left(\frac{7.67 - 10}{\sqrt{2}}\right) = .4221$

d) $P(10.88 \le X \le 13.22) = \Phi\left(\frac{13.22 - 10}{\sqrt{2}}\right) - \Phi\left(\frac{10.88 - 10}{\sqrt{2}}\right) = .2555$

f) $P(X \le x) = .81$, $z = .88$, $.88 = \frac{x - 10}{\sqrt{2}}$, $x = 11.2445$

g) $P(X \ge x) = .04$, $z = 3.33$, $1 - 3.33 = \frac{x - 10}{\sqrt{2}} =$

4a) $P(X \le 0) = P\left(Z \le \frac{0 - -7}{\sqrt{14}}\right) = .9693$

b) $P(X \ge -10) = 1 - P\left(Z \le \frac{-10 - -7}{\sqrt{14}}\right) = .7887$

c) $P(-15 \le X \le -1) = \Phi\left(\frac{-1 - -7}{\sqrt{14}}\right) - \Phi\left(\frac{-15 + 7}{\sqrt{14}}\right) = .9293$

d) $P(-5 \le X \le 2)\ \Phi\left(\frac{2 - -7}{\sqrt{14}}\right) - \Phi\left(\frac{-5 - -7}{\sqrt{14}}\right) = .2884$

f) $P(X \le x) = .75$, $z = .68$, $.68 = \frac{x + 7}{\sqrt{14}}$, $x = -4.46$

g) $P(X \le x) = .27$, $z = .61$, $.61 = \frac{x + 7}{\sqrt{14}}$, $x = -4.72$

9a) $P(X \ge 3.2) = 1 - P\left(Z \le \frac{3.2 - 3}{\sqrt{.12}}\right) = .0478$

b) $P(X \le 2.7) = P\left(Z \le \frac{2.7 - 3}{\sqrt{.12}}\right) = .00621$

10a) $P(X \le 1) = \text{normcdf}(-\infty, 1, 1.07, .014) = .016062$

b) $P(X \le 1) = \text{normcdf}(-\infty, 1, 1.05, .016) = .000889$, decrease in underweight

c) .03 and .05

11a) $P(X \le x) = .75$, $z = .68$, $.68 = \frac{x - 4.3}{.12}$, $x = 4.3804$

$P(X \le x) = .25$, $z = -.67$, $-.67 = \frac{x - 4.3}{.12}$, $x = 4.2196$

12a) $P(X \le .005) = \text{normalcdf}(-\infty, .005, .0046, \sqrt{9.6 \times 10^{-8}}) = .9017$

b) $P(.004 \le X \le .005) = .9017 - \text{normcdf}(-\infty, .004, .0046, \sqrt{9.6 \cdot 10^{-8}}) = .8752$

c) $P(X \le x) = .10$, $z = -1.28$, $-1.28 = \frac{x - .0046}{\sqrt{9.6 \times 10^{-8}}}$, $x = .0042$

d) $P(X \le x) = .99$, $z = 2.33$, $2.33 = \frac{x - .0046}{\sqrt{\sigma^2}}$, $x = .0053$

13a) $P(X \le 23) = \text{normcdf}(-\infty, 23, 23.8, \sqrt{1.28}) = .2398$

b) $P(X \ge 24) = 1 - \text{normalcdf}(-\infty, 24, 23.8, \sqrt{1.28}) = .4298$

c) $P(24.2 \le X \le 24.5) = \text{norm}(24.5) - \text{norm}(24.2) = .0937$

d) $P(X \le x) = .75$, $z = .68$, $.68 = \frac{x - 23.8}{\sqrt{1.28}}$, $x = 24.56$

e) $P(X \le x) = .95$, $z = 1.65$, $1.65 = \frac{x - 23.8}{\sqrt{1.28}}$, $x = 25.66$

5.2

a) $P(X \geq 0) = 1 - \text{normalcdf}(-\infty, 0, 3.2 + 2.1, \sqrt{6.5 + 3.5}) = .636$

c) $P(X \geq 1) = 1 - \text{normalcdf}(-\infty, 1, 3(3.2) + 5(-2.1), \sqrt{3^2(6.5) + 5^2(3.5)}) = .4375$

e) $P(-x \geq x \geq x) = .8684$

4a) mean = 8.6 mm, $\sigma = 1.697$

b) $N\left(4.3, \frac{.12^2}{12}\right) = N(4.3, .0012)$

5) $X = 2A + 3B$ $A = N(37, .49)$ $B = N(24, .09)$

$P(144 \leq K \leq 147) = \text{normalcdf}(-\infty, 147, 146, \sqrt{1.25}) - \text{normalcdf}(-\infty, 144, 146, \sqrt{1.25}) = .7776$

8a) $P(x_1 + x_2 + x_3 \geq 9.5) = 1 - \text{normalcdf}(-\infty, 9.5, 3+3+3, \sqrt{.12^2 + .12^2 + .12^2}) = .0081$

b) $P(x \leq 3.1) = \text{normalcdf}(-\infty, 3.10, 3, \sqrt{\frac{.12^2}{7}}) = .9863$

9a) $\mu_{box} = 22.66$, $\sigma^2_{box} = .004312$ X = box of 22

b) $P(X \leq x) = .25$, $z = -.67$, $-.67 = \frac{x - 22.66}{\sqrt{.004312}}$ $x = 22.616$

$P(X \leq x) = .75$, $z = .68$, $.68 = \frac{x - 22.66}{\sqrt{.004312}}$ $x = 22.7047$

17a) $\mu_{20} = 20 \cdot 6340 = 126800$, $\sigma_{20} = \sqrt{20 \cdot 2500^2} = 11180.3$

b) $\mu_{30} = 63400$, $\sigma_{\bar{x}_{30}} = \frac{2500}{\sqrt{30}} = 456.4$

19) $X = A + B$, $A = N(30000, 4000^2)$, $B = N(45000, 3000^2)$

$P(X \geq 85000) = 1 - \text{Normalcdf}(-\infty, 85000, 30000 + 45000, \sqrt{4000^2 + 3000^2}) = .02275$