

- 1 (a) Discrete
 (b) Continuous
 (c) Continuous
 (d) Continuous
 (e) Continuous

2. (a) Not a probability distribution.
 Probability cannot be negative

(b) It is a probability distribution.

3 (a)

X	P(x)
0	0.0178
1	0.0533
2	0.1111
3	0.24
4	0.2444
5	0.3333

(b)	X · P(x)
	0
	0.0533
	0.2222
	0.72
	0.9776
	1.6665
Σ	3.6396

Mean, $\mu = \sum X \cdot P(x) = 3.6$

(c)	$X^2 \cdot P(x)$
	0
	0.0533
	0.4444
	2.16
	3.9104
	8.3325
Σ	14.9006

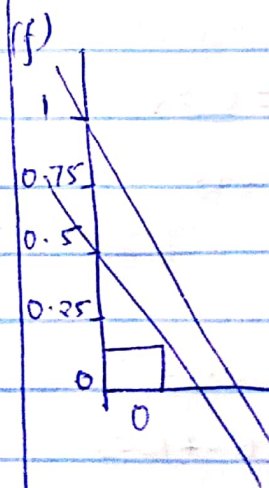
$$\sigma = \sqrt{\sum X^2 \cdot P(x) - \mu^2}$$

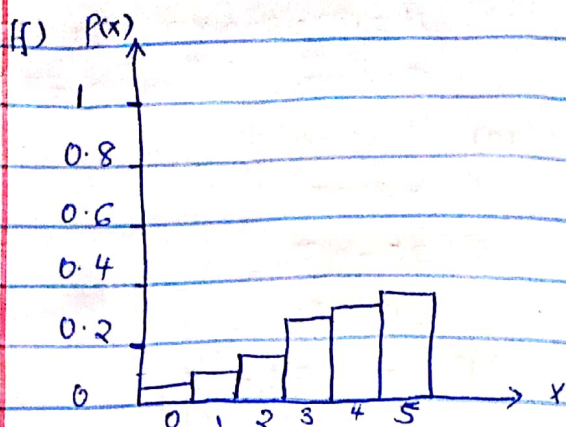
$$= \sqrt{14.9006 - 3.6396^2}$$

$$= 1.3$$

(d) $P(X \geq 3) = P(X=3) + P(X=4) + P(X=5)$
 $= 0.24 + 0.2444 + 0.3333$
 $= 0.8177$

(e) $P(X \leq 1) = P(X=0) + P(X=1)$
 $= 0.0178 + 0.0533$
 $= 0.0711$





4. $n=10$, $p=\frac{1}{3}$, $q=\frac{2}{3}$

$$P(X=x) = \binom{n}{x} p^x q^{n-x}$$

(a) $P(X=2) = 0.1950$

(b) $P(X \leq 2) = 0.2990$

5. $n=15$, $p=0.3$, $q=0.7$

(a) $P(X \leq 5) = 0.7220$

(b) $P(X \geq 3) = 0.8730$

(c) $P(X=15) = 0$

6. $n=10$, $p=0.25$, $q=0.75$

(a) $P(X \leq 2) = 0.5260$

(b) $P(X \geq 8) = 0.0004$

(c) $P(X=5) = 0.0580$

(d) $E(X) = \mu = np = 10 \times 0.25 = 2.5$

(e) $\sigma = \sqrt{npq} = \sqrt{10(0.25)(0.75)} = 1.369$

7. (a) $p = 0.154$

(b) $P(X=0) = 0.035$

(c) $P(X \geq 1) = 0.965$

(d) The results are complement of each other.

(e) $P(X < 5) = 0.816$

(f) $P(X=5) = 0.109$

It is not ~~usual~~ unusual since the probability is greater than 0.05.

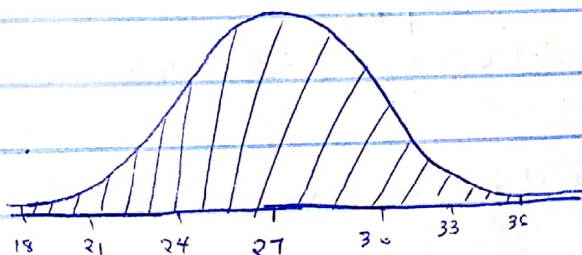
8. (a) $\mu = 27$, $\sigma = 3$

$P(18 \leq X \leq 36)$

$$Z = \frac{X - \mu}{\sigma}$$

$$Z_1 = \frac{18 - 27}{3} = -3$$

$$Z_2 = \frac{36 - 27}{3} = 3$$



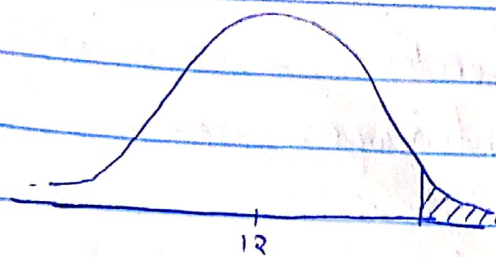
$$\begin{aligned} P(-3 \leq Z \leq 3) &= P(Z \leq 3) - P(Z \leq -3) \\ &= 0.999 - 0.001 \\ &= 0.998 \end{aligned}$$

(b) $P(15 \leq X)$ $\mu = 12$, $\sigma = 1.5$

$$Z = \frac{15 - 12}{1.5} = 2$$

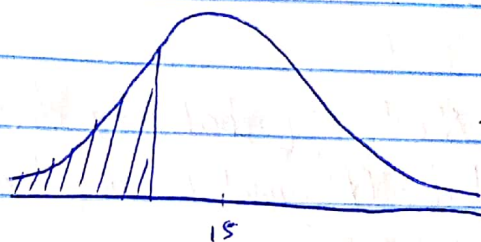
$$P(Z \leq 2)$$

$$\begin{aligned} P(Z \geq 2) &= 1 - P(Z \leq 2) \\ &= 1 - 0.9772 \\ &= 0.0228 \end{aligned}$$



$$(c) P(X \leq 13.5), \mu = 15, \sigma = 2.5$$

$$Z = \frac{13.5 - 15}{2.5} = -0.6$$



$$P(Z \leq -0.6) = 0.2743$$

9 (a) 95%

$$P(-Z \leq Z \leq z) = 0.95$$

$$2P(Z \leq z)$$

$$P(Z \leq z) - P(Z \leq -z) = 0.95$$

$$2P(Z \leq z) - 1 = 0.95$$

$$2P(Z \leq z) = 1.95$$

$$P(Z \leq z) = 0.975$$

$$z = 1.96$$

(b) 18%

$$P(Z > z) = 0.18$$

$$1 - P(Z < z) = 0.18$$

$$P(Z < z) = 0.82$$

$$z = 0.92$$

(c) 34%

$$P(Z < z) = 0.34$$

$$z = -0.41$$

$$10. \mu = 170, \sigma = 30$$

$$(a) P(X > 200)$$

$$P\left(Z > \frac{200 - 170}{30}\right)$$

$$P(Z > 1) = 1 - P(Z < 1)$$

$$= 1 - 0.8413$$

$$= 0.1587$$

$$(b) P(165 \leq X \leq 225)$$

$$P\left(\frac{165 - 170}{30} \leq Z \leq \frac{225 - 170}{30}\right)$$

$$P(-0.17 \leq Z \leq 1.83)$$

$$P(Z \leq 1.83) - P(Z \leq -0.17)$$

$$0.9664 - 0.4325$$

$$= 0.5339$$

$$(c) P(X \leq 160)$$

$$P\left(Z \leq \frac{160 - 170}{30}\right)$$

$$P(Z \leq -0.33)$$

$$= 0.0004 \times 125$$

$$= 0.3694 \times 125$$

$$= 46 \text{ boys}$$

$$11. \mu = 48, \sigma = 6$$

$$(a) P(X < x) = 0.06$$

$$Z = \phi^{-1}(0.06) = -1.55$$

$$Z = \frac{X - \mu}{\sigma}$$

$$-1.55 = \frac{X - 48}{6}$$

$$X = (-1.55)(6) + 48 = 38.7 \text{ months}$$

$$12. \mu = 63.6, \sigma = 2.5$$

$$(a) P(63 \leq X \leq 65)$$

$$P\left(\frac{63 - 63.6}{2.5} \leq Z \leq \frac{65 - 63.6}{2.5}\right)$$

$$P(-0.24 \leq Z \leq 0.56)$$

$$P(Z \leq 0.56) - P(Z \leq -0.24)$$

$$= 0.7123 - 0.4052$$

$$= 0.3071$$

$$(b) P(\bar{x} > 64)$$

$$Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$Z = \frac{64 - 63.6}{\frac{2.5}{\sqrt{100}}} = 1.6$$

$$P(Z > 1.6) = 0.0548$$

$$(c) P(\bar{x} < 62.1)$$

$$Z = \frac{62.1 - 63.6}{\frac{2.5}{\sqrt{75}}} = -5.2$$

$$P(Z < -5.2) = 0$$

$$(d) P(X > x) = 0.02$$

$$P(X < x) = 0.98$$

$$Z = \phi^{-1}(0.98) = 2.05$$

$$2.05 = \frac{x - 63.6}{2.5}$$

$$x = 68.73 \text{ inches}$$

$$(e) P(X < x) = 0.02$$

$$Z = \Phi^{-1}(0.02) = -2.05$$

$$\frac{-2.05}{2.5} = \frac{x - 63.6}{2.5}$$

$$x = 58.48 \text{ inches}$$

$$13. \mu = 31000, \sigma = 3000$$

$$(a) P(\bar{X} < 30500)$$

$$P\left(\frac{30500 - 31000}{\frac{3000}{\sqrt{100}}}\right)$$

$$P\left(Z < \frac{30500 - 31000}{\frac{3000}{\sqrt{100}}}\right)$$

$$P(Z < -1.67) = 0.0475$$

$$(b) P(\bar{X} > 31800)$$

$$P\left(Z > \frac{31800 - 31000}{\frac{3000}{\sqrt{50}}}\right)$$

$$P(Z > 1.89) = 0.0294$$

$$(c) P(30000 \leq \bar{X} \leq 32000)$$

$$P\left(\frac{30000 - 31000}{\frac{3000}{\sqrt{80}}} \leq Z \leq \frac{32000 - 31000}{\frac{3000}{\sqrt{80}}}\right)$$

$$P(-2.36 \leq Z \leq 2.36)$$

$$P(Z \leq 2.36) - P(Z \leq -2.36)$$

$$0.9909 - 0.0091 = 0.9818$$

$$14. \mu = np = 300 \times 0.05 = 15$$

$$\sigma = \sqrt{npq} = \sqrt{15 \times 0.95} = 3.7749$$

(a)

$$P(X < 25)$$

$$P\left(\frac{25 - 15}{3.7749}\right)$$

$$P\left(Z < \frac{25 - 15}{3.7749}\right)$$

$$P(Z < 2.65) = 0.996$$

$$(b) P(5 \leq X \leq 25)$$

$$P\left(\frac{5 - 15}{3.7749} \leq Z \leq \frac{25 - 15}{3.7749}\right)$$

$$P(-2.65 \leq Z \leq 2.65)$$

$$P(Z \leq 2.65) - P(Z \leq -2.65)$$

$$0.996 - 0.004$$

$$= 0.992$$

$$(c) P(X > 35)$$

$$P\left(Z > \frac{35 - 15}{3.7749}\right)$$

$$P(Z > 5.3) = 0$$