# Problem 1

a) - let A denote that a lightbulb is produced by machine A

- same for B

- let D denote that a lightbulb is defective

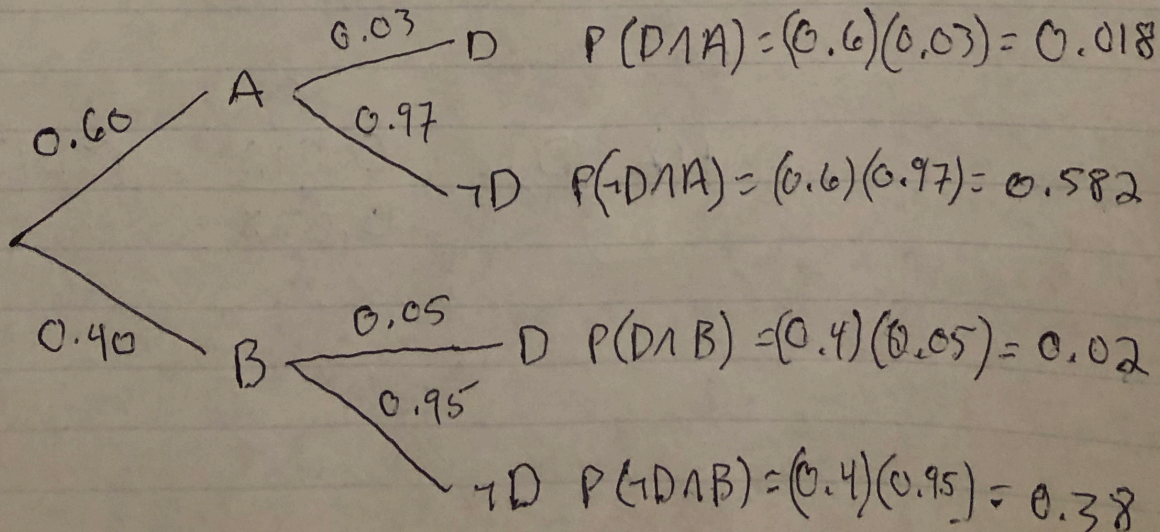
$P(A) = 0.60 \qquad P(B) = 0.40$

$P(D \mid A) = 0.03 \qquad P(D \mid B) = 0.05$

b) Before we can make a $2 \times 2$ table, we need:

$P(D \wedge A)$, $P(D \wedge B)$,

$P(\neg D \wedge A)$; $P(\neg D \wedge B)$



$P(D \wedge A) = 0.018$ $\quad P(\neg D \wedge A) = 0.582$

$P(D \wedge B) = 0.02$ $\quad P(\neg D \wedge B) = 0.38$

| | $D$ | $\neg D$ |
|---|---|---|
| $A$ | 0.018 | 0.582 |
| $B$ | 0.02 | 0.38 |

c) $P(A \mid D) = \dfrac{P(A \wedge D)}{P(D)}$

$= \dfrac{0.018}{P(D)}$

where $P(D) = P(D \wedge A) + P(D \wedge B)$

$= 0.018 + 0.02$

$= 0.038$

so

$P(A \mid D) = \dfrac{0.018}{0.038} = 0.4737$

# Problem 2

| | Lake Path | Hilly Path | Wooded Path | Total |
|---|---|---|---|---|
| Novice | 20 | 6 | 2 | 28 |
| Exp Rec | 15 | 12 | 5 | 32 |
| Athlete | 2 | 9 | 14 | 25 |
| Total | 37 | 27 | 21 | 85 |

marginal distribution for path preference

- Lake path → $37/85 = 0.4353$
- Hilly path → $27/85 = 0.3176$
- Wooded path → $21/85 = 0.2471$

marginal distribution for experience level

- Novice → $28/85 = 0.3294$
- Exp Rec → $32/85 = 0.3765$
- Athlete → $25/85 = 0.2941$

b) conditional distribution of ~~ph~~ path preferences for athletes in training

- Lake path → $^{2}/_{25} = 0.08$
- Hilly path → $^{9}/_{25} = 0.36$
- Wooded path → $^{14}/_{25} = 0.56$

c) $28/85 = 0.3294$

32.94% are novices

d) $15/32 = 0.4688$

46.88% of experienced recreational bicyclists preferred the lake path

e) Athletes ∩ Hilly path

$9/85 = 0.1059$

10.59% surveyed are athletes who preferred hilly path

# Problem 3

(from binomial pdf function on calculator)

| P(X=0) | P(X=1) | P(X=2) | P(X=3) | P(X=4) | P(X=5) |
|---|---|---|---|---|---|
| 0.3707 | 0.4069 | 0.1786 | 0.0392 | 0.0043 | 0.0002 |

a) $P(X \geq 2)$

$= P(X=2) + P(X=3) + P(X=4) + P(X=5)$

or

$1 - P(X < 2)$ because

$P(X<2) + P(X \geq 2) = 1$ so

$1 - [P(X=1) + P(X=0)]$

$= 1 - 0.4069 - 0.3707$

$= 0.2224$

b) $E(X) = n \cdot p = 5 \cdot 0.18 = 0.9$

c) $\sigma^2 = n \cdot p \cdot q = 5(0.18)(0.82) = 0.738$

$\sigma = \sqrt{0.738} = 0.8591$

Problem 4

Using normal cdf function from calculator

a) $P(Z \leq 0.78) =$

$0.7823$

b) $P(Z \leq -1.12) =$

$0.1314$

c) $P(Z \geq -2.06) =$

$1 - P(Z \leq -2.06) =$

$0.9803$

d) $P(-0.85 \leq Z \leq 1.33) =$

$P(Z \leq 1.33) - P(Z \leq -0.85) =$

$0.9082 - 0.1977 =$

$0.7106$

# Problem 5

Using invNorm function on calculator

a) $z$ for $P(Z \leq z) = 0.59$

$z = 0.2275$

b) $z$ for $P(Z \leq z) = 0.31$

$z = -0.4959$

c) $z$ for $P(Z \geq z) = 0.82$

$P(Z \geq z) = 1 - P(Z \leq z)$

$1 - P(Z \leq z) = 0.82$

$P(Z \leq z) = 1 - 0.82 = 0.18$

$z$ for $P(Z \leq z) = 0.18$

$z = -0.9154$