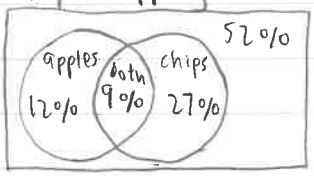
Probability Problem Set

1 Grocery Shopping

a)



b) Apples: 21 %
Chips: 36 %

c) 12 + 27 = 39 %

d) 27 %

e) 52 %

2 Haircuts

a) X is # people pay $32

$32X + 20(2900 - X) \geq 87000$

$X \geq 2416.7$

$X \geq 2417$

a) $\sum_{n=2417}^{2900} {}_{2900}C_n \cdot (0.85)^n \cdot (0.15)^{2900-n} = 0.9936 = 99.36\%$

b) $99.36\%^3 = 98.10\%$

c) $(2900 \cdot 0.85 \cdot 32) + (2900 \cdot 0.15 \cdot 20) = \$87580$

3 Random Parts

$1.5 + 1 \sim 2.0 + 0.5$ For add to 3 $(2+1)$

$2.5 + 0 \sim 2.001 + 0.499$ For add to 2 $(2+0)$ $\rightarrow 1/3$

$1.001 + 1.499 \sim 1.499 + 1.001$ For add to 2 $(1+1)$

4 The Five Second Rule

a) $\left(\frac{1}{5}\right)^3 \left(\frac{4}{5}\right)^{12} \cdot {}_{15}C_3 = 25\%$

b) $25\% + \left(\frac{1}{5}\right)^2 \left(\frac{4}{5}\right)^{13} \cdot {}_{15}C_2 + \left(\frac{1}{5}\right)\left(\frac{4}{5}\right)^{14} \cdot {}_{15}C_1 + \left(\frac{4}{5}\right)^{15} \cdot {}_{15}C_0 = 64.8\%$

c)

5 Some Proofs about Standard Deviation

Data: 1, 2, 3, 4, 5 ; mean: 3 → 7, 8, 9, 10, 11 ; mean: 9 (constant: 6)

a) $\sigma_1 = \sqrt{\frac{(1-3)^2 + (2-3)^2 + (3-3)^2 + (4-3)^2 + (5-3)^2}{5}} = \sqrt{2}$

$\sigma_2 = \sqrt{((7-9)^2 + (8-9)^2 + (9-9)^2 + (10-9)^2 + (11-9)^2)/5} = \sqrt{2}$

$\sigma_1 = \sigma_2$

b) Constant: 2 → Data: 2, 4, 6, 8, 10 ; mean: 6

$\sigma_3 = \sqrt{\frac{(2-6)^2 + (4-6)^2 + (6-6)^2 + (8-6)^2 + (10-6)^2}{5}} = 2\sqrt{2}$

$2 \cdot \sigma_1 = \sigma_3 = c \cdot \sigma_1$