x	1 (Success)	0 (failure)
$P(X=x)$	p	$1-p$
$xP(X=x)$	p	0
$x-\mu$	$1-p$	$-p$
$(x-\mu)^2$	$(1-p)^2$	$(-p)^2$
$P(X=x)(x-\mu)^2$	$p(1-p)^2$	$(1-p)p^2$

Total: p $\qquad \Sigma xp(X=x) = \mu$

Total: $p(1-2p+p^2) + p^2 - p^3$

$$= p - 2p^2 + \cancel{p^3} + p^2 - \cancel{p^3}$$

$$= p - p^2$$

$$= p(1-p)$$

$$\sigma = \sqrt{p(1-p)}$$

P(exactly one exceeds) $\qquad$ Ariana, (A) $\quad$ Brittany, (B) $\quad$ Carton, (C) $\quad$ Damian (D)

$P(A = \text{exceeds}, B = \text{not}, C = \text{not}, D = \text{not})$

$= P(A = \text{exceeds})\, P(B = \text{not})\, P(C = \text{not})\, P(D = \text{not})$

$= 0.3 \times 0.7 \times 0.7 \times 0.7$

$= (0.3)^1 (0.7)^3$

$= 0.103$

$P(\text{single scenario}) = P(k \text{ successes})\, P(n-k \text{ failures})$

$$= \underbrace{p \times p \times \ldots \times p}_{k} \times \underbrace{(1-p) \times (1-p) \times (1-p) \times \ldots \times (1-p)}_{n-k}$$

$$= p^k (1-p)^{n-k}$$

X = # of students who own a car

success = "own a car" $\quad P(\text{success}) = 0.38$

$n = 20$

X is binomally distributed with $n = 20$ and $p = 0.38$

$$P(X=k) = \binom{20}{k} 0.38^k (0.62)^{20-k}$$

a) None own a car

$$P(X=0) = \binom{20}{0} 0.38^0 (0.62)^{20}$$

$$= 7.04 \times 10^{-5}$$

b) Mean of standard dev of X

$$\mu = np = 20 \times 0.38 = 7.8 \qquad \sigma = \sqrt{np(1-p)} = \sqrt{20 \times 0.38 \times .62}$$
$$= 2.17$$

c) No more than 2 own a car

$$P(X \leq 2) = P(X=0 \text{ or } X=1 \text{ or } X=2)$$
$$= P(X=0) + P(X=1) + P(X=2)$$
$$= \binom{20}{0} 0.38^0 \times 0.62^{20} + \binom{20}{1} 0.38^1 \times 0.62^{19} + \binom{20}{2} 0.38^2 \times 0.62^{18}$$
$$= 1 \times 1 \times 0.62^{20} + \frac{20!}{1!\,19!} 0.38 \times 0.62^{19} + \frac{20!}{2!\,(18)!} 0.38^2 \times 0.62^{18}$$
$$= 0.0000704 + 20 \times 0.38 \times 0.62^{19} + \frac{20 \times 19}{2} 0.38^2 \times 0.62^{18}$$
$$= 0.0000704 + 0.00086 + 0.0051$$
$$= 0.00596$$

d) More than 2 own a car $\quad P(X > 2) = 1 - P(X \leq 2)$

$$= 1 - 0.00596$$
$$= 0.994$$