1.

a. B: variable is Poisson (approximately)
   Wasp nests are a rare event and is counted over a fixed area. This model would assume that the wasp nest event is uniform, random and independent and wasps may tend to cluster together in areas that are a more suitable habitat.
b. A: variable is Binomial (approximately)
   There is a fixed number of trials with a binary outcome (success and failure). The binomial model assumes that each trial has an independent outcome and as the trials are done with the same student, every reaction could be affected by another or over time altering the probability. i.e. they may become fatigued.
c. D: variable is none of the above.
   The time between packets arriving at a router is not a binary event, nor are we counting the number of packet per second so we can not use any of the above methods. It is also likely that the time between is not independent and packets will arrive in bursts.

2. Let X = the chance a battery lasts ≥ 5 hours

a. $P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$

$$P(X=2) = \binom{6}{2} 0.1^2 * 0.9^{6-2}$$
$$= \left(\frac{6!}{2!\,4!}\right) * 0.1^2 * 0.9^4$$
$$= \frac{6*5}{2*1} * 0.01 * 0.9^4$$
$$= 0.15 * 0.9^4$$

b. $E(X) = np = 6(0.1) = 0.6$

3.

a. $P(X \le 0)$ =0.38
b. $P(X \le 1)$ =0.64
c. $P(X = 1) = P(X \le 1) - P(X \le 0) = 0.26$
d. $P(X > 1) = 1 - P(X \le 1) = 0.36$
e. $P(X \ge 2) = 1 - P(X \le 1) = 0.36$
f. 0 errors at P(X=0) = 0.38

0	1	2	3	4
0.38	0.64-0.38	0.83-0.64	0.65-0.83	1-0.95
0.38	0.26	0.19	0.12	0.05

4.

a.

$$P(X=2) = \left(1 - \frac{1}{100}\right)^{2-1} * \frac{1}{100}$$
$$= \frac{99}{100} * \frac{1}{100} = \frac{99}{10{,}000}$$

b.

$$P(X=3) = \left(1 - \frac{1}{100}\right)^{3-1} * \frac{1}{100}$$
$$= \left(\frac{99}{100}\right)^{2} * \frac{1}{100} = \frac{99^2}{1{,}000{,}000}$$
$$P(X \leq 3) = P(X=3) + P(X=2) + P(X=1)$$
$$= \frac{99^2}{100^3} + \frac{99}{100^2} + \frac{1}{100}$$
$$= \frac{99^2 + 99 * 100 + 100^2}{100^3}$$

-1P

simplify!!!

$= \ldots\ldots$?

c.

$$E(X) = \frac{1}{p} = \frac{1}{\left(\frac{1}{100}\right)} = 100$$

d.

$$P(X=x) = \left(1 - \frac{1}{100}\right)^{x-1} * \frac{1}{100} = \frac{970{,}299}{100{,}000{,}000}$$
$$= \left(\frac{99}{100}\right)^{x-1} * \frac{1}{100} = \frac{99^3}{100^4}$$
$$= \left(\frac{99}{100}\right)^{x-1} = \left(\frac{99}{100}\right)^{3}$$
$$x = 4$$

✓

5.

a.

i. $P(X=2) = \frac{e^{-12} * 12^2}{2!} = \frac{144}{2} e^{-1} = 72e^{-12}$

ii. $P(X<2) = P(X=0) + P(X=1)$

$$= \frac{e^{-12} * 12^0}{0!} + \frac{e^{-12} * 12^1}{1!} = 1e^{-12} + 12e^{-12}$$
$$= 13e^{-12}$$

iii. $P(X \geq 2) = 1 - P(X<2)$

$$= 1 - 13e^{-12}$$

✓

b.

$$P(X=30) = \frac{e^{-24} * 24^{30}}{30!} = \frac{(24^{30})e^{-24}}{30!}$$

6.

$$X \sim Poi(2.2 * 30)$$
$$E(X) = 66$$
$$Var(X) = 66$$
$$SD(X) = \sqrt{66}$$
$$\mu(X) = 66$$

$$Cost:$$
$$\mu = 66 * \$250$$
$$SD = \sqrt{66} * \$250 = \$(250\sqrt{66})$$