A Shipment of 20 similar laptop computers to a retail outlet contains 3 that are defective. If a school makes a random purchase of 2 of these computers, find the probability distribution for the number of defectives.

Let $X$ be a random variable whose values $x$ are the possible numbers of defective computers purchased by the school. Then $x$ can only take the numbers 0, 1 and 2

Now

$$f(0) = P(X=0) = \frac{\binom{3}{0}\binom{17}{2}}{\binom{20}{2}} = \frac{\frac{3!}{0!(3-0)!} \cdot \frac{17!}{2!(17-2)!}}{\frac{20!}{2!(20-2)!}}$$

$$= \frac{\frac{3!}{\cancel{2!}}}{\frac{\cancel{20} \times 19 \times \cancel{18!}}{(2\times1)(18!)}} \times \frac{17 \times 16 \times \cancel{15!}}{(2\times1)(\cancel{15!})} = \frac{136}{190} = \boxed{\frac{68}{95}}$$

$$f(1) = P(X=1) = \frac{\binom{3}{1}\binom{17}{1}}{\binom{20}{2}} = \frac{\frac{3!}{1!(3-1)!} \times \frac{17!}{1!(17-1)!}}{\frac{20!}{2!(20-2)!}}$$

$$= \frac{\frac{3 \times 2!}{2! \, 1!} \times \frac{17 \times 16!}{1! \times 16!}}{10 \, \frac{20 \times 19 \times 18!}{(2 \times 1) \, 18!}} = \boxed{\frac{51}{190}}$$

$$f(2) = P(X=2) = \frac{\binom{3}{2}\binom{17}{0}}{\binom{20}{2}} = \frac{\frac{3!}{2!(3-2)!} \times \frac{17!}{0!(17-0)!}}{\frac{20!}{2!(20-2)!}}$$

$$= \frac{\frac{3 \times 2!}{2! \, 1!} \times \frac{17!}{0! \, 17!}}{10 \, \frac{20 \times 19 \times 18!}{(2 \times 1) \, 18!}} = \boxed{\frac{3}{190}}$$

The event $X \leq 2$

$$P(X \leq 2) = P(X=0) + P(X=1) + P(X=2)$$

$$= \frac{68}{95} + \frac{51}{190} + \frac{3}{190}$$

$$= \frac{(2 \times 68) + 51 + 3}{190} = \frac{190}{190} = 1$$