3. c.

$$E(X_{max}) = \sum_{x=1}^{f} x \cdot P(X_{max}=x) = \sum_{x=1}^{f} x \cdot \frac{(3x(x-1)+1)}{f^3}$$

hint

$$= \frac{1}{f^3} \cdot \sum_{x=1}^{f} x \cdot (3x^2 - 3x + 1) = \frac{1}{f^3} \left(3\sum_{i=1}^{f} x^3 - 3\sum_{x=1}^{f} x^2 + \sum_{x=1}^{f} x \right)$$

$$= \frac{1}{f^3}\left(3 \cdot \frac{f^2(f+1)^2}{4} - \left(\frac{f(f+1)(f+2)}{6}\right) + \frac{f(1+f)}{2}\right)$$

$$= \frac{f(f+1)}{2f^3}\left[\frac{3}{2}f(f+1) - \frac{f+2}{3} + 1\right]$$

$$= \frac{f+1}{2f^2}\left[\frac{3}{2}(f^2+f) - \frac{1}{3}(f+2) + 1\right]$$

$\Longrightarrow$

$$\lim_{f\to\infty} \frac{E(X_{max})}{f} = \lim_{f\to\infty} \frac{f+1}{2f^3}\left[\frac{3}{2}(f^2+f) - \frac{1}{3}(f+2) + 1\right]$$

$$= \underbrace{\frac{\frac{3}{2}\cdot(f^2+f)(f+1)}{2f^3}} - \underbrace{\frac{\frac{1}{3}(f+2)(f+1)}{2f^3}}_{\to 0} + \underbrace{\frac{(f+1)}{2f^3}}_{\to 0}$$

$$= \boxed{\frac{3}{4}}$$