1) There are $\binom{n}{k}$ ways to choose $k$ rows, and $\binom{n}{k}$ ways to choose $k$ columns. There are $k!$ ways to pair the rows and columns, so the answer is $\binom{n}{k}^2 k!$.  

2) A) $\binom{k}{\lambda}$  
B) $k$  
C) $2^k$  

3) By the binomial theorem,  
$$\sum_{k=2}^{\infty} 4.5^k \left( \binom{n}{k} \right) = \sum_{k=2}^{\infty} \binom{n}{k} 4.5^k - \binom{n}{1} 4.5^1 - \binom{n}{0} 4.5^0 = 5.5^n - 4.5n - 1$$  

4) A) There are $\frac{1}{2}$ pairs of vertices corresponding to possible edges, and each edge is added or not-added independently, so there are $2^{\frac{1}{2}}$ labelled graphs on $n$ vertices.  
B) For each set $S$ of $k$ vertices, define random variable $\sigma_s(G)$ which is 1 if $S$ is an independent set of vertices of $G$, and 0 otherwise. Since $S$ has $\binom{k}{2}$ possible edges, the probability that none of them is in $G$ (the probability that $S$ is independent) is $(\frac{1}{2})^{\binom{k}{2}} = 2^{-\frac{k(k-1)}{2}}$. Noting that $G$ has $\binom{n}{k}$ sets of $k$ vertices and appealing to the linearity of expectation,  
$$E[\sigma_k(G)] = \sum_{S \subseteq G} E[\sigma_s(G)] = \sum_{S \subseteq \binom{k}{2}} \left(1 \ast 2^{\binom{k}{2}} + 0 \ast \left(1 - 2^{\binom{k}{2}}\right)\right) = \binom{n}{k} 2^{\binom{k}{2}}.$$