CS363 Networks & Collective Behavior - Homework 2

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1. There is a question here.

Solution: From the question we have,

$$n = 1 \times 10^9 \qquad\qquad p = 1 \times 10^{-5}$$

(a)

$$< m >= n\mathbf{C}2 \cdot p$$
$$< m >= 1 \times 10^9\mathbf{C}2 \cdot 1 \times 10^{-5}$$
$$< m >= 4.99 \times 10^{12}$$

(b)

$$< k >= (n-1) \cdot p$$
$$< k >= (1 \times 10^9 - 1) \cdot 1 \times 10^{-5}$$
$$< k >= 9999.99$$

(c)

$$< k >= (n-1) \cdot p$$
$$1 \times 10^5 = (1 \times 10^9 - 1) \cdot p$$
$$p = \frac{1 \times 10^5}{1 \times 10^9 - 1} = 1 \times 10^{-4}$$

(d)

$$APL = \frac{\ln(n)}{\ln(< k >)}$$
$$\frac{\ln(1 \times 10^9)}{\ln(9999.99)} = 2.25$$

(e) No, all the nodes will not be a part of the giant component. This is because the probability p is near to 0 rather than 1, thus, not all nodes will be connected.