Intelligent Data Mining - Exercise 2

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1 Assignment 1: Bonferroni's Principle

a. The number of days of observation was raised to 2000.

- number of pairs of days

$$\binom{2000}{2} \approx 2 \times 10^6$$

- number of suspected pairs

$$5 \times 10^{17} \times 2 \times 10^6 \times 10^{-18} = 1,000,000$$

b. The number of people observed was raised to 2 billion (and there were therefore 200,000 hotels).

- number of pairs of people

$$\binom{2 \times 10^9}{2} \approx 2 \times 10^{18}$$

- chance that they will visit the same hotel

$$\frac{0.0001}{2 \times 10^5} = 5 \times 10^{-10}$$

- chance that they will visit the same hotel on two different given days

$$(5 \times 10^{-10})^2 = 2.5 \times 10^{-19}$$

- number of suspected pairs

$$2 \times 10^{18} \times 5 \times 10^5 \times 2.5 \times 10^{-19} = 250,000$$

c. We only reported a pair as suspect if they were at the same hotel at the same time on three different days.

- chance that they will visit the same hotel on three different given days
$$(10^{-9})^3 = 10^{-27}$$
- number of "triples" of days
$$\binom{1000}{3} \approx 1.7 \times 10^8$$
- number of suspected pairs
$$5 \times 10^{17} \times 1.7 \times 10^8 \times 10^{-27} = 0.085$$

2 Assignment 2: Base of the natural logarithm

a. In terms of e, give approximations to

  (a) $(1.01)^{500}$
  $$= (1 + 0.01)^{500} = e^{0.01 \times 500} = e^5$$

  (b) $(1.05)^{1000}$
  $$= (1 + 0.05)^{1000} = e^{0.05 \times 1000} = e^{50}$$

  (c) $(0.9)^{40}$
  $$= (1 - 0.1)^{40} = e^{-0.1 \times 40} = e^{-4}$$

b. Use the Taylor expansion of e^x to compute, to three decimal places:

  (a) $e^{1/10}$
  $$\approx 1 + \frac{1}{10} + \frac{1}{200} + \frac{1}{6000} + \frac{1}{240000} \approx 1.105$$

  (b) $e^{-1/10}$
  $$\approx 1 - \frac{1}{10} + \frac{1}{200} - \frac{1}{6000} + \frac{1}{240000} \approx 0.904$$

  (c) e^2
  $$\approx 1 + 2 + \frac{4}{2} + \frac{8}{6} + \frac{16}{24} \approx 7.000$$