Mathematical & Statistical tools in Forensic Audit (Unit 26 – Module 1)

DFA

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FINANCIAL POSITION
POTENTIAL FOR BUSINESS FAILURE- Zeta Analysis

A comprehensive quantitative indicator used to predict failure is Altman's "Z-score," which equals

$$\frac{\text{Working capital}}{\text{Total assets}} \times 1.2 + \frac{\text{Retained earnings}}{\text{Total assets}} \times 1.4$$

$$+ \frac{\text{Operating income}}{\text{Total assets}} \times 3.3 + \frac{\text{MV of common \& preferred shares}}{\text{Total liabilities}} \times 0.6$$

$$+ \frac{\text{Sales}}{\text{Total assets}} \times 0.999$$

N.B- 1. Operating income = Net sales - cost of goods sold
2. Observed to be valid for majority cases, including KFA

Score & interpretation

Score	Probability of illiquidity or failure
1.80 or less	Very high
1.81- 2.99	Not sure
3.0 or greater	Unlikely

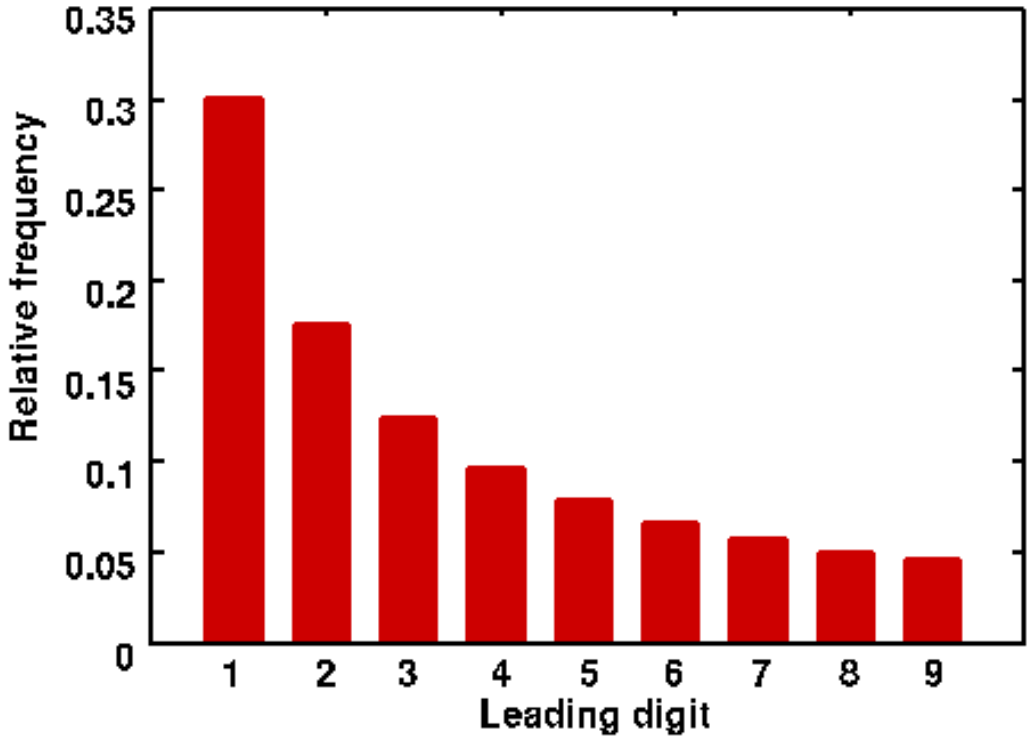
Benford's Law

- Benford's law is sometimes referred to as digital/frequency analysis
- It's reasonable to expect that the first digit of any value in an dataset (i.e. Vendor Invoices) value to be random
- Equal chance of the first digit being an number between 1 and 9
- Although it's counterintuitive, some numbers appear more frequently than others in many datasets
- Digit 1is the leading digit 30% of the time, 2 is the leading digit 18% of the time, 3 is the leading digit 12% of the time and larger numbers decreasingly so

Benford's Law

One might have thought P(1) = P(2) = P(3) = ….P(9) = 0.11..
But…

P(1) = 0.30
P(2) = 0.18
P(3) = 0.12
P(4) = 0.10
P(5) = 0.08
P(6) = 0.07
P(7) = 0.06
P(8) = 0.05
P(9) = 0.05



Benford's law- testing

- **Examples:**
- Baseball statistics
- Areas of rivers, Molecular weights of atoms
- Electricity bills, Stock market quotes
- Populations of towns, Physical and mathematical constants
- Populations of cities across India
- Heights of buildings
- File sizes on your hard drive
- **Benford's Law <u>should not be used as a final decision-making tool by itself,</u>**

Benford's Law- Arizona cheque fraud case

- Auditors/Forensic accountants use Benford's law to detect fraud
- Human choices are not random
- When people "massage numbers" in an attempt to defraud, they tend to use more 8s and 9s as the first digit than expected from Benford's law

State of Arizona vs Wayne James Nelson

- Invented or altered numbers are not likely to follow Benford's law
- In 1993 , Wayne James Nelson was accused of trying to defraud the state of Arizona of two million dollars (USD)
- Nelson, wrote 23 cheques to a fictitious vendor in seemingly random amounts
- But his plan had a major flaw, his amounts weren't random enough
- In the trial the defendant was accused of issuing cheques to a vendor that did not exist

Relative Size Factor(RSF)

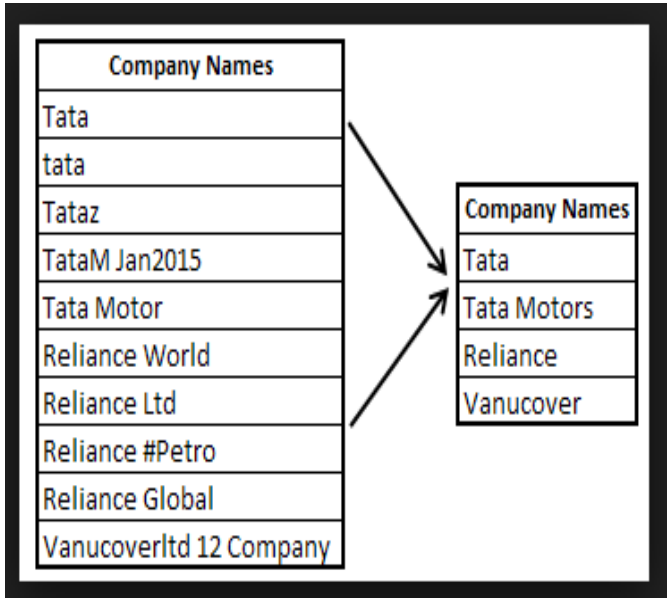
- The relative size factor (RSF) test is an important error-detecting test."
- $$\text{Relative Size Factor} = \frac{\text{Largest Record in a Subset}}{\text{Second Largest Record in a Subset}}$$
- If the largest vendor invoice is a large multiple of the second largest, we would investigate

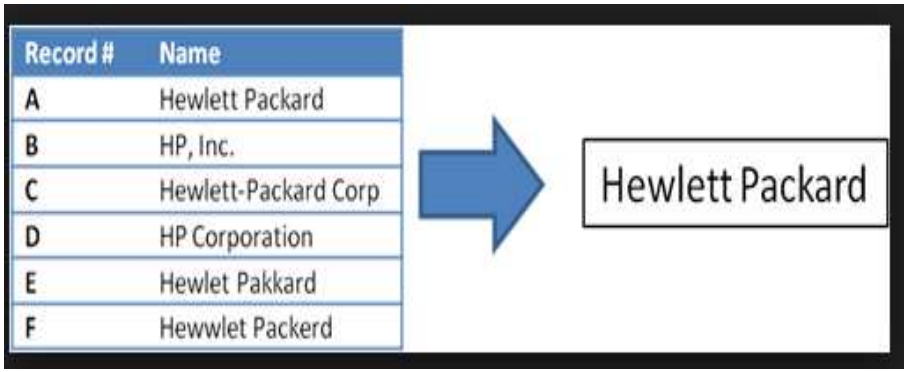
LEVENSHTEIN DISTANCE (edit distance)

- Minimum Edit distance between two strings str1 and str2 is defined as the minimum number of insert/delete/substitute operations required to transform str1 into str2
- Eg : if str1 = "ab", str2 = "abc" then making an insert operation of character 'c' on str1 transforms str1 into str2
- So, edit distance between str1 and str2 is 1
- It gives us a measure of the number of single character insertions, deletions or substitutions required to change one string into another.
- Eg: if str1 = "INTENTION" and str2 = "EXECUTION", then the minimum edit distance between str1 and str2 turns out to be 5
- All operations are performed on str1

Fuzzy Matching

- Fuzzy matching – approximate matching





DFA Exam related MCQ

1. Forensic Audit is?
(A) An Art
(B) A Science _
(C) A Profession
(D) ***All of these***

2, Which of the following statements is true ?
(A) Creative Accounting and Book- keeping are synonymous
(B) Book-cooking and Accounting are complementary to each other
(C) ***Accounting starts from where Book-keeping ends***
(D) Both (B) and (C)

3. ISO 37001 standard in a Company or bank deals with
(A) Manufacturing quality
(B) NPA analysis
(C) HR & Quality standard
(D) Anti Bribery / Corruption systems

4. Benford's law is—
(A) accounting law
(B) economics concept
(C) Fraud detection tool
(D) cost audit technique

5. What is the risk management model in global banking
A. NPA Model
B. CAMELS
C. Operations- Credit-Market (OCM)
D. none of the above

6. Which law addresses frauds of money laundering —
(A) SEBI Laws
(B) IT Act
(C) CVC Guidelines
(D) PMLA

7. Forensic Audit software example
(A) Access
(B) Excel
(C) IDEA
(D) None of these

8. The forensic audit of a Company or Bank is done
(A) Compulsorily per quarter
(B) at the instruction of CBI / RBI / MCA / SFIO
(C) at the direction of State Government
(D) none of the above

9. Anti Fraud regulator(s) in India is / are
A. SEBI
B. SFIO
C. RBI
D. CERT-In

10. String matching in forensic audit is done by
(A) Benford's Law
(B) Fuzzy matching
(C) RSF
(D) None of these

11. Banks carry out _____ as fraud preventive mechanism
(A) Borrower KYC
(B) Borrower Due diligence
(C) Credit risk management
(D) all of the above

12. Tiger Team tests indicate
A. Forensic audit
B. Internal audit
C. Financial statement fraud
D. Ethical hacking