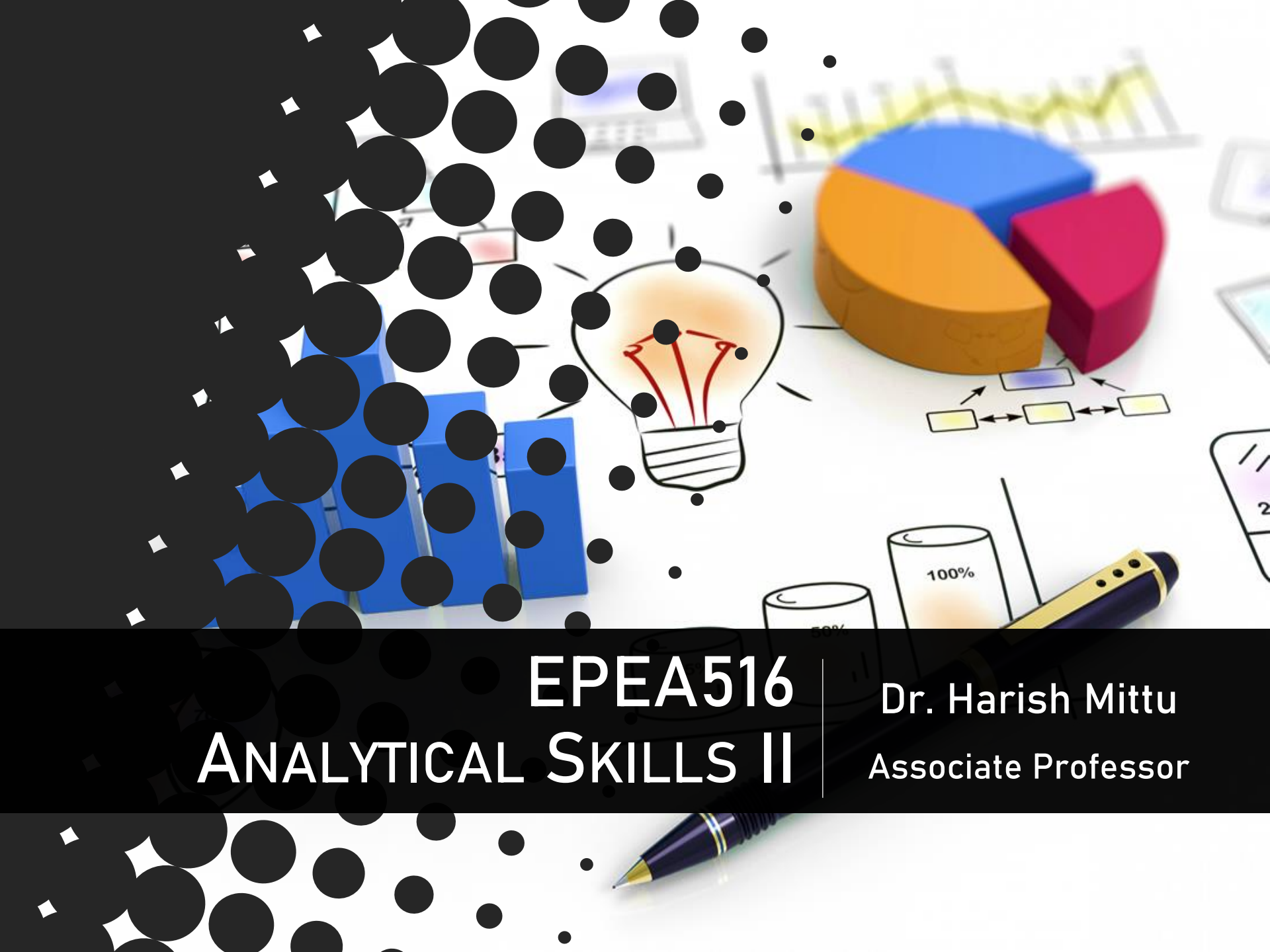

EPEA516
Analytical Skills II

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Learning Outcomes

After this lecture, you will be able to

- develop understanding about the basics of coded inequalities,
- analyze properties, conditions, and rules of coded inequalities,
- solve various problems relating to coded inequalities and relations.

Basics

- Equality
  - ‘ = ’ – Equal
- Inequality
  - ‘ ≠ ’ - Not Equal
  - ‘ > ’ - Greater than
  - ‘ < ’ - Less than
  - ‘ ≥ ’ - Greater than equals to
  - ‘ ≤ ’ - Less than equals to

Symbolic Representation

- A = B
  - A is equal to B.
- A > B
  - B is less than A.
  - A is greater than B.
- A < B
  - B is greater than A.
  - A is Less than B.

Symbolic Representation

- $A \geq B$
  - A is greater than B or equal to B.
  - Either A is greater than B or A is equal to B.
- $A \leq B$
  - A is less than B or equal to B.
  - Either A is less than B or A is equal to B.
- $A > < B$ i.e. $A \neq B$
  - No Relationship.

Example

- A = B > C < D
  - A = B - A is equal to B.
  - A > C - A is greater than C.
  - A > < D
  - A and D has no relations.
  - Between A and D conditions for no-relationship exits.

Properties

- Addition
  - If $a \geq b$, then $a + c \geq b + c$
  - If $a \leq b$, then $a + c \leq b + c$
- Subtraction
  - If $a \geq b$, then $a - c \geq b - c$
  - If $a \leq b$, then $a - c \leq b - c$

Properties

- Multiplication
  - If $a \geq b$, then $ac \geq bc$, where $c>0$
  - If $a \leq b$, then $ac \leq bc$, where $c>0$
- Division
  - If $a \geq b$, then $a/c \geq b/c$, where $c>0$
  - If $a \leq b$, then $a/c \leq b/c$, where $c>0$

Properties

- Transitivity
  - If $a \leq b$ and $b \leq c$ then, $a \leq c$
- Inverse Additive
  - If $a \geq b$, then $-a \leq -b$, if $a>0$, $b>0$
  - If $a \leq b$, then $-a \geq -b$, if $a>0$, $b>0$

Properties

- Inverse Multiplicative
  - If $a \geq b$, then $1/a \leq 1/b$, if $a>0$, $b>0$
  - If $a \leq b$, then $1/a \geq 1/b$, if $a>0$, $b>0$

Conditions for No Relationship

- $>$ $<$ - Greater than & Less than
- $\geq$ $\leq$ - Greater than Equal to & Less than Equal to
- $>$ $\leq$ - Greater than & Less than Equal to
- $\geq$ $<$ - Greater than Equal to & Less than
- $<$ $>$ - Less than & Greater than
- $\leq$ $\geq$ - Less than Equal to & Greater than Equal to
- $<$ $\geq$ - Less than & Greater than Equal to
- $\leq$ $>$ - Less Equal to & than Greater than

Conditions – Combining Two Inequalities

- Two Inequalities - Common Term
- Definite Conclusion
  - All Signs in Combined Inequality
  - Pointing in Same Direction

Conditions – Combining Two Inequalities

- Rule
  - $A \leq B \leq C \leq D$
    - $A = D$, $A < D$, and $A \leq D$
    - $A = C$, $A < C$, and $A \leq C$
    - $B = D$, $B < D$, and $B \leq D$

Conditions – Combining Two Inequalities

- Rule
  - $A \leq B < C \leq D$
    - $A < D$ and $A \neq D$
    - $B < D$ and $B \neq D$
    - $A < C$ and $A \neq C$

Conditions – Combining Two Inequalities

- Rule
  - $A \geq B \geq C \geq D$
    - $A = D$, $A > D$, and $A \geq D$
    - $A = C$, $A > C$, and $A \geq C$
    - $B = D$, $B > D$, and $B \geq D$

Conditions – Combining Two Inequalities

- Rule
  - $A \geq B \geq C > D$
    - $A = C$, $A > C$, and $A \geq C$
    - $A > D$ and $A \neq D$
    - $B > D$ and $B \neq D$

Conditions – Combining Two Inequalities

- Rule
  - $A \leq B \geq C \geq D$
  - No Relation – A & C and A & D
  - $A \leq B \geq C \leq D$
  - No Relation – A & C, B & D, and A & D
  - $A \geq B \leq C \geq D$
  - No Relation – A & C, B & D, and A & D

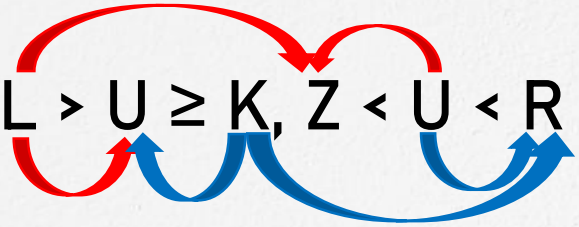
Options

- (a) If only conclusion I follows.
- (b) If only conclusion II follows.
- (c) If either conclusion I or II follows.
- (d) If neither conclusion I nor II follows.
- (e) If both conclusion I and II follow.

Problem 1

- Statements
  - Q = Z, C ≥ G , G ≥ Q, Q ≥ R
- Conclusions
  - I. G ≥ Z and II. C ≥ R
- Explanation
  - C ≥ G ≥ Q = Z ≥ R
  - G ≥ Z (I follows)
  - C ≥ R (II follows)

Problem 2

- Statements
  - L > U ≥ K, Z < U < R 
- Conclusions
  - I. L > Z and II. K < R
- Explanation
  - L > U > Z or L > Z (I follows)
  - K ≤ U < R or K < R (II follows)

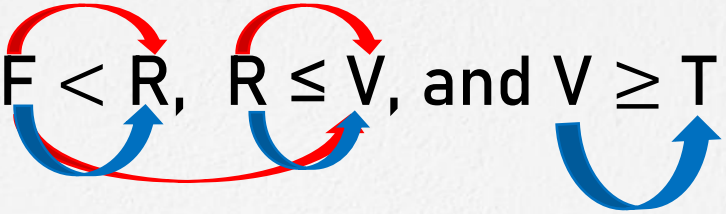
Problem 3

- P % Q means P is greater than Q.
- P δ Q means P is neither greater than nor smaller than Q.
- P @ Q means P is smaller than Q.
- P © Q means P is either smaller than or equal to Q.
- P S Q means P is either greater than or equal to Q.
- Statements – F @ R, R © V, and V S T

  (or F $<$ R, R $\leq$ V, and V $\geq$ T)
- Conclusions – I. V % F (or V $>$ F) II. F @ T (or F $<$ T)

Problem 3

- Statements - $F < R$, $R \leq V$, and $V \geq T$



- Conclusions - I. $V > F$ II. $F < T$
- Explanation
  - $F < R \leq V$
  - $F < V$ or $V > F$ (I follows)
  - $F < R$, $R \leq V \geq T$ (II does not follow)

Problem 4

- A @ B means A is not smaller than B.
- A # B means A is neither smaller than nor equal to B.
- A S B means A is neither greater than nor smaller than B.
- A * B means A is not greater than B.
- A % B means A is neither greater than or equal to B.
- Statements - J @ K, K % M, M # T

(or J $\not<$ K or J $\geq$ K , K $\not\geq$ M or K $<$ M, M $\not\leq$ T or M $>$ T)

- Conclusions: I. K % T II. K @ T

I. K $\not\geq$ T or K $<$ T II. K $\not<$ T or K $\geq$ T

Problem 4

- Statements –
- $J \geq K$, $K < M$, $M > T$
- Conclusions-
- I. $K < T$ and II. $K \geq T$
- Explanation
  - $J \geq K < M > T$
  - Either I ($K < T$) or II ($K \geq T$) must be true.

Problem 5

- A @ B means A is smaller than B.
- A S B means A is greater than B.
- A # B means A is either smaller than or equal to B.
- A * B means A is either greater than or equal to B.
- A % B means A is neither smaller than nor greater than B.
- Statements - P @ W, W * D , D S J

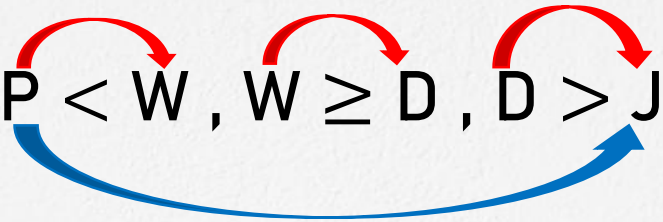
  $P < W, W \geq D , D > J$

- Conclusions - I. J @ P and II. J @ W

  I. $J < P$ and II. $J < W$

Problem 5

- Statements - $P < W$, $W \geq D$, $D > J$



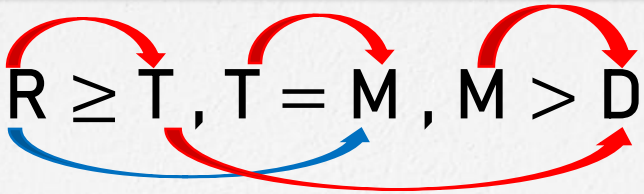
- Conclusions - I. $J < P$ and II. $J < W$
- Explanation
  - $P < W \geq D > J$
  - $W \geq D > J$
  - $J < W$ (II follows)
  - $P < W \geq D > J$ (I does not follow)

Problem 6

- P # Q means P is not smaller than Q.
- P % Q means P is not greater Q.
- P @ Q means P is neither smaller than nor equal to Q.
- P S Q means P is neither greater than nor equal to Q.
- P © Q means P is neither smaller than nor greater than Q.
- Statements - R # T, T © M, M @ D
  or (R $\not<$ T or R $\geq$ T , T $\not<\not>$ M or T = M , M $\not\leq$ D or M > D)
- Conclusions - I. D S T and II. R # M
  or I. D $\not\geq$ T or D < T and II. R $\not<$ M or R $\geq$ M

Problem 6

- Statements - $R \geq T$, $T = M$, $M > D$



- Conclusions - I. $D < T$ and II. $R \geq M$
- Explanation
  - $R \geq T = M > D$
  - $T > D$ or $D < T$ (I follows)
  - $R \geq M$ (II follows)

Problem 7

- Which of the following symbols should replace the question mark in the given expression in order to make the expressions ‘K ≤ H’ and ‘M > J’ definitely true?

$$H \geq I = J \; ? \; K \leq L < M$$

- >
- ≥
- ≤
- Either < or ≤
- =

Problem 7

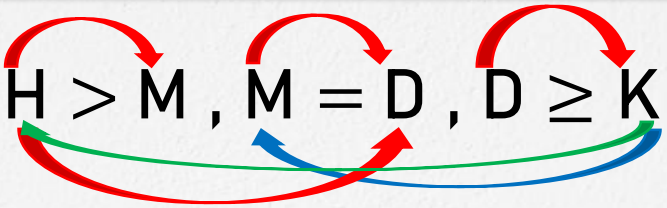
- $K \leq H$ and $M > J$
- $H \geq I = J$? $K \leq L < M$
- Explanation
  - $H \geq I = J = K \leq L < M$

Problem 8

- P % Q means P is neither greater than nor smaller than Q.
- P S Q means P is neither smaller than nor equal to Q.
- P © Q means P is neither greater than nor equal to Q.
- P * Q means P is not greater than Q.
- P @ Q means P is not smaller than Q.
- Statements - H S M, M % D, D @ K
  or (H $\not\leq$ M or H $>$ M , M $\not\geq$ $\not<$ D or M $=$ D , D $\not<$ K or D $\geq$ K)
- Conclusions - I. H S D II. K * M III. K © H
  or (I. H $\not\leq$ D or H $>$ D II. K $\not\geq$ M or K $\leq$ M III. K $\not\geq$ H or K $<$ H

Problem 8

- Statements - $H > M$, $M = D$, $D \geq K$



- Conclusions – I. $H > D$ II. $K \leq M$ III. $K < H$
- Explanation
  - $H > M = D \geq K$
  - $H > D$ (I follows)
  - $K \leq M$ (II follows)
  - $K < H$ (III follows)

Conclusion

- Coding Inequality
  - ‘ ≠ ’ - Not Equal
  - ‘ > ’ - Greater than
  - ‘ < ’ - Less than
  - ‘ ≥ ’ - Greater than equals to
  - ‘ ≤ ’ - Less than equals to

Summary

- Coding Inequalities
  - Basics
  - Symbolic Representation
  - Properties
  - Conditions & Rules
  - Problems - Coded Inequalities & Relations

That’s all for now…