



MULTIPLE CHOICE QUESTIONS

Ian Couper

University of the Witwatersrand

Useful resource:

Case SM and Swanson DB. *Constructing Written Test Questions for the Basic and Clinical Sciences, 2001.*

This document can be downloaded from:

<http://www.NBME.ORG/about/itemwriting.asp>

WHY MCQs?

- ✓ Satisfies most criteria for objectivity
- ✓ High validity in cognitive domain
- ✓ Excellent reliability
- ✓ Practical to administer, rapid to machine score
- ✓ Very useful in both formative and summative assessments
- ✓ Wide sampling possible

WHAT ARE THE PROBLEMS WITH MCQs?

- ✓ **Difficult to construct**
- ✓ **Time consuming to write**
- ✓ **Security: *students re-create own Q-banks with answers!***
- ✓ **If not careful only isolated factual recall**
- ✓ **Need to be carefully tested**
- ✓ **Danger with questions of obscurity**

Two Families of Multiple-Choice Item Formats

True/False Items:

Select all of the options that are true:

C (A/B/both/neither)

K (complex multiple true/false)

X (multiple true/false)

Simulations: Patient Management Problems (PMPs)

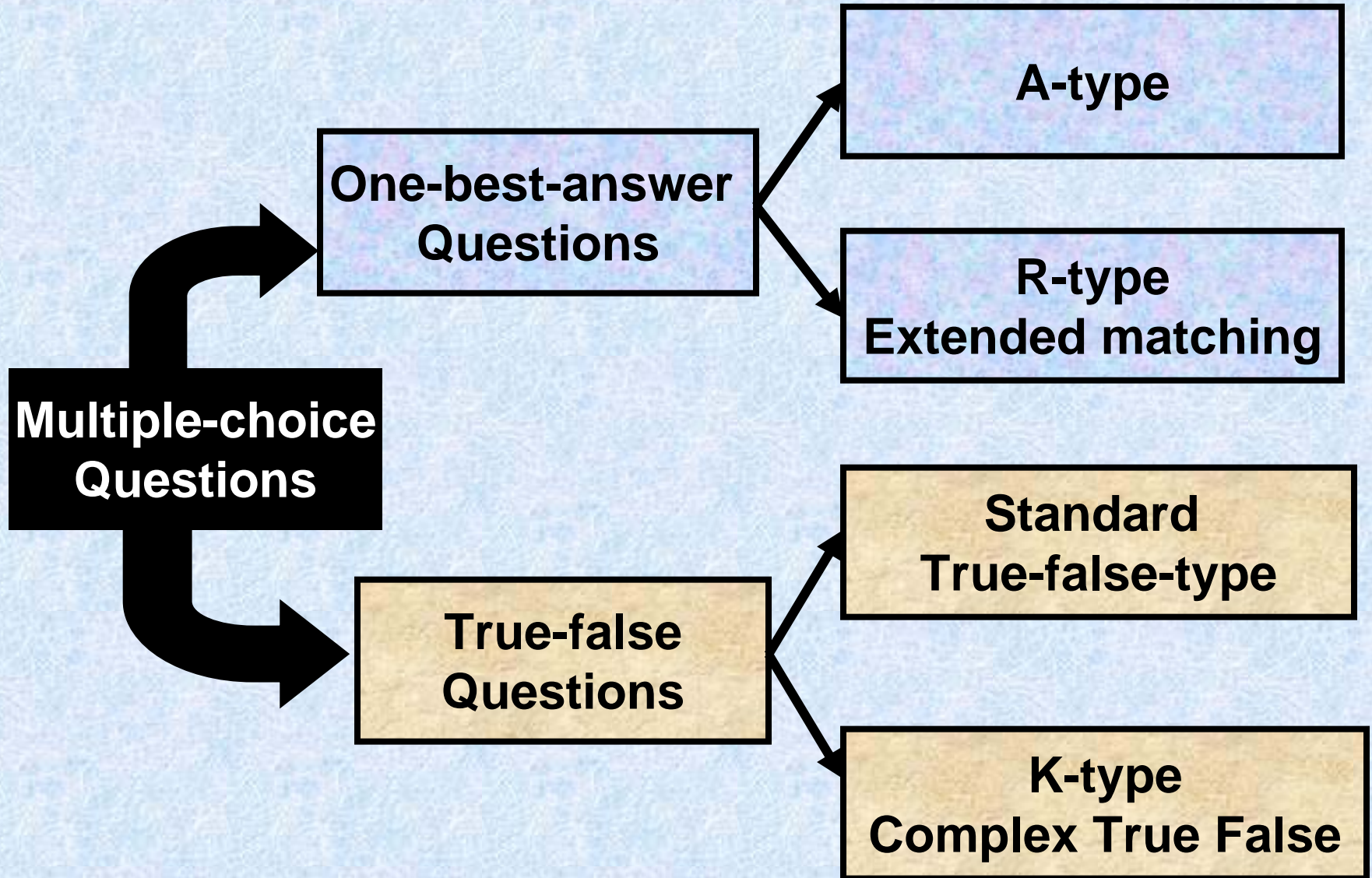
One-Best Answer Items:

Select the single best response:

A (3 or more options, single items or sets)

R (Extended Matching items in sets of 2-20 items)

Multiple-Choice Question Formats



Downing et al: Comparison of A and X type of MCQs

- 1) Collected data from three different examinations
 - 2) Data from >21,000 candidates
 - 3) Data from >1,000 A type
 - 4) Data from ~2,500 X type
-
- a) X type were slightly more internally consistent
 - b) High correlation between candidates' performance in A compared to X
 - c) A type found to have higher difficulty index
 - d) A more valid for determining clinical competence, as determined by a higher correlation with the rating giving by clinical supervisors.

TRUE/FALSE

VERSUS

SINGLE RESPONSE

- Thought to be easy to write
- Most widely used in UK
- Theoretically wide coverage
- Often samples less content
- Absolute certainties
- More likely misunderstood
- More problematic
- Guessing
- Relative truths
- How often is often?
- Often discarded by reviewers

- Most widely used in USA
- Tests higher cognitive learning
- Reduced reward for guessing
- Nearest to clinical reasoning
- Difficult to write
- Compare like with like
- Subset mentality
- Distracter dangers
- Beware of numbers
- The long correct answer
- Convolution is not desirable

SINGLE BEST ANSWER (TYPE A)

Nearest question type to actual clinical reasoning, hence popularity, the best answer, HOWEVER, not the only answer!

Higher cognitive domain tested rather than straight recall.

Guessing reduced by 60% - 80%

Problems related to plausible distracters, some of which could be correct answers. Danger in obscurity!!

Coverage a contentious issue

Difficult to write

MULTIPLE TRUE AND FALSE (X TYPE)

The easiest type of MCQ to write (often badly)

Widest sample coverage claimed

Guessing gives 50% bonus marks (unless negatively marked)

Does not discriminate as well as the Type A

More difficult to write a higher level of question

Item answer linkage a problem (mutually exclusive.....)

ABSOLUTENESS A PROBLEM FOR ITEM WRITER

- ⇒ If everything was purely black and white in medicine, higher cognitive processes would not be invoked
- ⇒ Candidates often confused by trying to work out what the examiner wants for an answer
- ⇒ Either completely right or completely wrong also allows the trained guesser to benefit, in other words, if not true it must be false
- ⇒ Two exact opposites (mutually exclusive) are a give away, one must be true and the other false, potentially marks for the taking.

The following are autosomal dominant conditions.

- A. fibrous dysplasia
- B. osteogenesis imperfecta
- C. osteoporosis
- D. Duchenne's muscular dystrophy
- E. achondroplasia



Totally False

Totally True

A
C
D

B
E

Which of the following statements about osteoarthritis are true and which are false?

- A. there is a genetic pre-disposition
- B. males are more affected than females
- C. hip joints are more affected than knee
- D. obesity is a risk factor in its development

False

True



A,B,C are not absolutely true or false.

Experts would only unanimously agree that **D** is true.

MULTIPLE TRUE AND FALSE

- ✓ Where does one start?
- ✓ By a review of the learning objectives
- ✓ Consider carefully facts, analysis or interpretation
- ✓ Avoid words like, always, never and try not to include a negative in the stem as well as any item
- ✓ Candidates are often confused by qualitative descriptions (e.g. sometimes) and prefer quantitative values, e.g., <20%

MULTIPLE TRUE AND FALSE

- ✓ Relationship between stem and each item
- ✓ Replace mutually exclusive items
- ✓ Avoid double statements in an item
- ✓ Avoid absolute precision, 56% of..., rather greater than half the population
- ✓ Try to put most of the text in the stem and make the item as simple as possible.
- ✓ Finally, check for ambiguity

WILMS' TUMOURS HAVE THE FOLLOWING CHARACTERISTICS:

- (a) excellent prognosis if treated appropriately
- (b) uniformly bad prognosis
- (c) the lung is a likely metastatic site
- (d) bones are likely metastatic sites
- (e) the tumour produces VMA

TFTFF

WILMS' TUMOURS HAVE THE FOLLOWING CHARACTERISTICS:

- (a) **excellent prognosis if treated appropriately**
- (b) **uniformly bad prognosis**
- (c) **the lung is a likely metastatic site**
- (d) **bones are likely metastatic sites**
- (e) **the tumour produces VMA**

TFTFF

THE FOLLOWING CONDITIONS ARE CONSIDERED TO BE PREMALIGNANT:

- (a) lentigo maligna
- (b) lipoma
- (c) arsenical keratosis
- (d) actinic keratosis
- (e) leukoplakia

WHAT ARE THE COMMON ERRORS?

- ⇒ Vagueness, frequently, often, common etc
- ⇒ Subsets, the answer must be one of the related items in an A type
- ⇒ Absoluteness, typically nothing is never in medicine
- ⇒ Too-long, examiners trying to include everything to make it correct
- ⇒ Same-word, occurs in stem and option
- ⇒ Convergence, when the correct answer has most of the rest
- ⇒ Grammar, excludes some of the options
- ⇒ Non-of-the-above, poor substitute for at least one correct answer
- ⇒ Things-change, lack of specifics may cause confusion
- ⇒ Perspective, another source of confusion, give required detail.

Most of the time

Usually

Frequently

Likely to occur

Probably

Commonly

Associated with

Rarely

Almost never

AVOID THESE ERRORS

THESE QUALIFIERS ARE USUALLY USED IN THE ITEMS AND CAUSE CONFUSION FOR THE CANDIDATES AS THEY ARE NOT AWARE OF EXACTLY WHAT THE EXAMINER IS ASKING

Worse still, experts seldom can agree

True statements about pseudogout include:

1. it occurs *commonly* in women
2. it is *often* associated with acute pain
3. it is usually hereditary
4. serum calcium levels are *frequently* raised

Is this because the incidence or prevalence is around 10% or 90%?

Often, does this mean 90% of the time or 2/5 cases?

Same problem arises when we talk about the common causes, how many? Anything above an incidence/prevalence of 10%, in which case maybe five or six causes, or do we mean all causes for 95% of the cases?

Collectively exhaustive “subset of options”, candidates can easily spot these and among them will usually be the correct answer for an A type

Indices of poor health status are:

- a) *equally distributed among all social classes*
- b) *over represented among the poor*
- c) *over represented among the middle and rich*
- d) *are impossible to calculate well enough to use*
- e) *are too inaccurate for use in determining health manpower needs*

The testwise candidate knows that the answer is most likely to be a, b or c. Common sense then might select b.

They say in medicine that nothing is never or always!! Rather everything can and does occur

In patients with advanced dementia, Alzheimer's type, the memory defect:

- a) can be treated adequately with phosphatidylcholine (lethicin)
- b) could be a sequela of early parkinsonism
- c) is never seen in patients with neurofibrillarly tangles at autopsy
- d) is never severe
- e) possibly involves the cholinergic system

C and d can be excluded immediately, and the use of the word adequately is questionable, which leaves b and e.

The correct answer is often longer than the rest as the examiner struggles to define it with exactness

Secondary gain is:

- a) synonymous with malingering
- b) a frequent problem in obsessive-compulsive disorders
- c) a complication of a variety of illnesses and tends to prolong many of them
- d) never seen in organic damage

Obviously c is an attempt to define what secondary gain is with exactness while d is never going to be the answer! b wasn't good either

Play on words gives away the correct answer, for example including the meaning in both the stem and item.

A 58 year old alcoholic who is confused and agitated says he is experiencing the unreal, this symptom is:

- a) depersonalisation
- b) derailment
- c) derealisation
- d) Focal memory deficit
- e) Signal anxiety

The question boils down to matching, and c becomes the obvious and correct answer.

Avoid the so-called convergence strategy, where the correct answer has the most similarities with the others.

Local anaesthetics are most effective in the :

- a) anionic form, acting from inside the nerve membrane
- b) cationic form, acting from inside the nerve membrane
- c) cationic form, acting from outside the nerve membrane
- d) uncharged form, acting from inside the nerve membrane
- e) uncharged form, acting from outside the nerve membrane

Note: the two items with most elements in common with the others, b and d; but the ion variations have three over the uncharged option's two, d and e.

Avoid using the “none of above option”.

The diagnosis of a large ovarian cyst is most strongly suggested by:

- a) anterior dullness, lateral tympany
- b) decreased peristalsis
- c) fluid wave
- d) shifting dullness
- e) none of the above

There is another problem here because b is somewhat difficult to confirm unless all signs of bowel activity are absent.

Stems which do not flow grammatically with the items cause problems.

A 60 year old man who had been found unconscious should first be given an iv administration of:

- a) examination of cerebrospinal fluid**
- b) glucose with vitamin B₁ (thiamine)**
- c) CT scan of the head**
- d) phenytoin**
- e) diazepam**

Clearly a and c can be excluded.

However, it can also be added that this type of flaw should never get through a Review Committee!

(What is that? - Pre- and post exam reviews)

Below is a very confusing item involving variable correctness depending upon the (unspecified) severity of the problem.

In children, ventricular septal defects are associated with:

- a) a systolic murmur
- b) pulmonary hypertension
- c) Tetralogy of fallot
- d) cyanosis

The problem with this question is obvious, but equally obvious is that the stem could have been worded differently, so this is easy to improve.

Finally, everything depends upon one's perspective

The way to a man's heart is through his:

- a) aorta
- b) pulmonary arteries
- c) pulmonary veins
- d) stomach
- e) antecubital vein

Obviously the addition of a qualifier clarifies the answer being sought:

- a) Metaphorically speaking..
 - b) A catheter may reach....
 - c) Venous blood....
-



Components of an A-type Question

A 35-year old man has had a stomach ache all afternoon. He ate the following lunch: two big McDonalds hamburgers, an ice cream shake, large fries.

Vignette,
Scenario,
Or Stem

Which is the most likely diagnosis?

Lead-in

- A. Abdominal aneurysm
- B. Appendicitis
- C. Bowel obstruction
- D. Cholecystitis
- E. Colon cancer
- F. Pancreatitis
- G. Too much lunch

Options A, B, C, D, E & F are
distractors

Option G is the *key*

Sample Good Question & 'Cover The Options' Rule

A 32-yo man has a 4-day history of progressive weakness in his extremities. He has been healthy except for an upper respiratory tract infection 10 days ago. His temperature is 100 F, BP 130/80, pulse 94, respirations 42 and shallow. He has symmetric weakness of both sides of the face and the proximal and distal muscles of the extremities. Sensation is intact. No deep tendon reflexes can be elicited; the plantar responses are flexor. Which of the following is the most likely diagnosis?

- A. Acute disseminated encephalomyelitis
- B. Guillain-Barré syndrome
- C. Multiple sclerosis
- D. Myasthenia gravis
- E. Polyneuritis

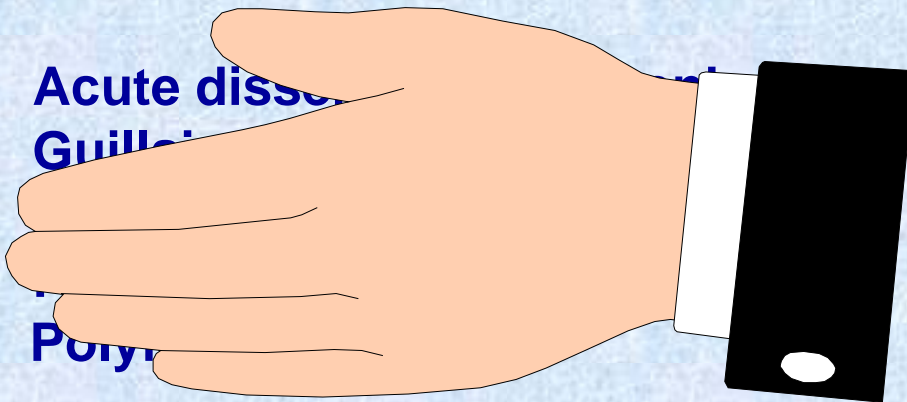
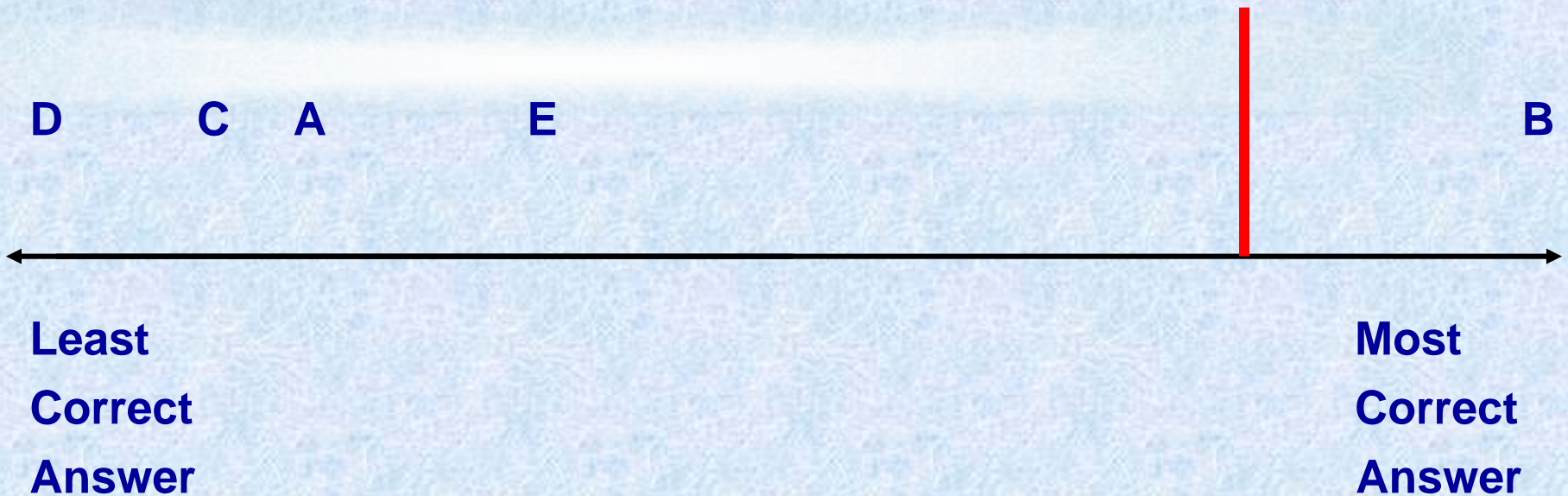


Diagram of Rank-Ordered Options for a Good One-Best-Answer Item



Note: Options must be homogeneous (eg, all diagnoses, all muscles).
You must be able to rank-order the options on the same dimension.

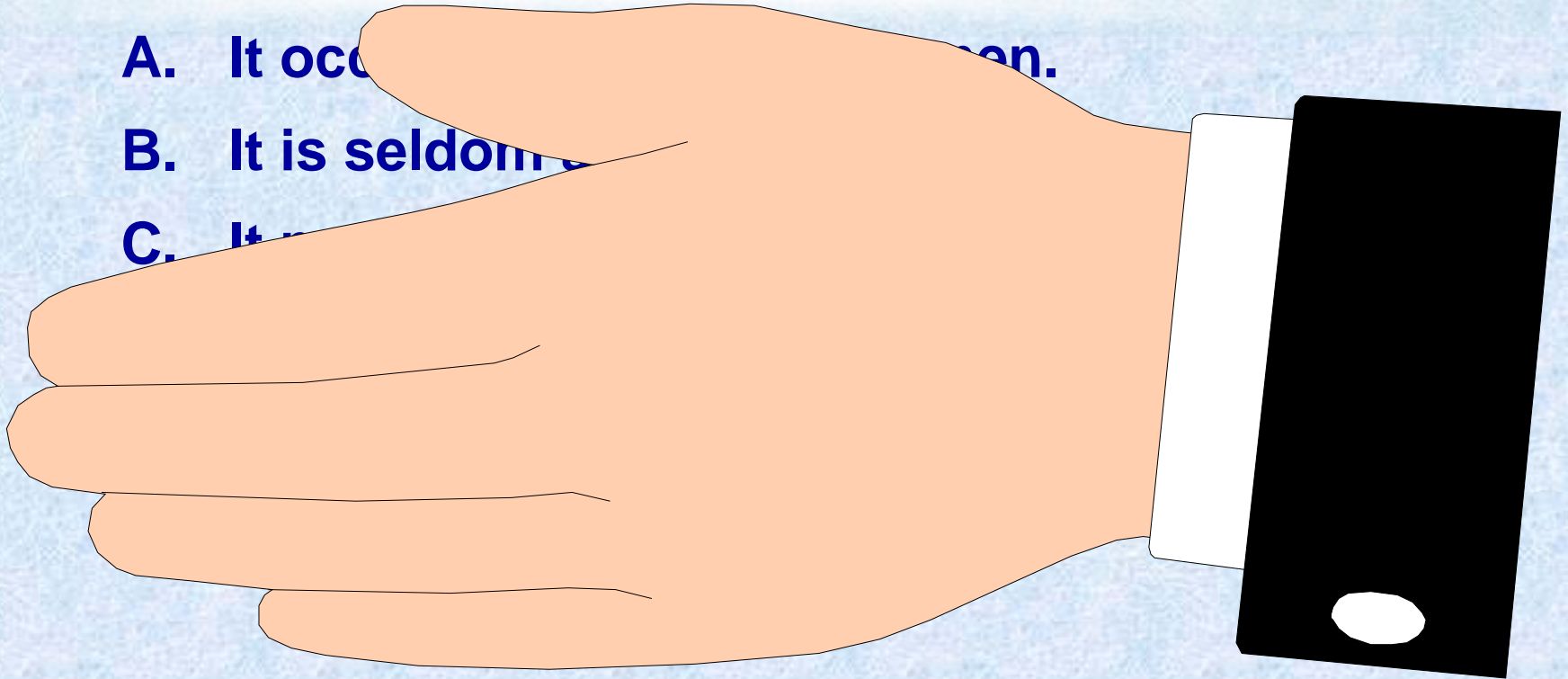
Sample Flawed Question & 'Cover The Options' Rule

Which of the following is true about pseudogout?

A. It occurs only in men.

B. It is seldom seen.

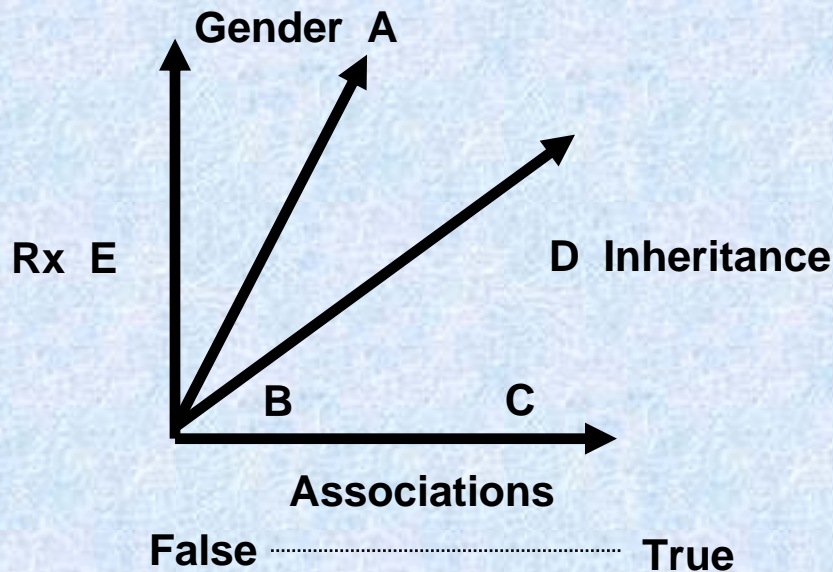
C. It is



Sample Flawed One-Best-Answer Item

Which of the following is true about pseudogout?

- A. It occurs frequently in women.
- B. It is seldom associated with acute pain in a joint.
- C. It may be associated with chondrocalcinosis.
- D. It is clearly hereditary in most cases.
- E. It responds well to treatment with allopurinol.



The #1 Rule For One-Best-Answer Questions

A 24-year old man comes to the urgent care unit
..... Which of the following is the most likely cause
of his pain?

- A. cholelithiasis
- B. diverticulitis
- C. acute appendicitis



Cover The Options Rule



***What is an
Extended Matching R-Set?***

Sample Set: Neuroanatomy

- A. Left anterior cerebral artery
- B. Left posterior cerebral artery
- C. Left middle cerebral artery
- D. Left lenticulostriate arteries
- E. Right anterior cerebral artery
- F. Right posterior cerebral artery
- G. Right middle cerebral artery
- H. Right lenticulostriate arteries

For each patient with neurologic abnormalities, select the artery that is most likely to be involved.

1. A 72-year-old right-handed man has weakness and hyperreflexia of the right lower limb, an extensor plantar response on the right, normal strength of the right arm, and normal facial movements.

Ans: A

2. A 68-year-old right-handed man has right spastic hemiparesis, an extensor plantar response on the right, and paralysis of the lower two-thirds of his face on the right. His speech is fluent, and he has normal comprehension of verbal and written commands.

Ans: G

Extended Matching Set: Components

Theme: Blood supply to the brain

Options:

- | | |
|-----------------------------------|------------------------------------|
| A. Left anterior cerebral artery | E. Right anterior cerebral artery |
| B. Left posterior cerebral artery | F. Right posterior cerebral artery |
| C. Left middle cerebral artery | G. Right middle cerebral artery |
| D. Left lenticulostriate arteries | H. Right lenticulostriate arteries |

Lead-in:

For each patient with neurological abnormalities, select the artery most likely to be involved.

Extended Matching Set: Components

Items:

Following a cerebral infarction, a 48-year-old man has a left spastic hemiparesis, an extensor plantar response on the left, and weakness of the lower two-thirds of his face on the left. He cannot draw a picture of a clock, and he has not shaved the right side of his face since the infarction.

A 68-year-old right-handed man has right spastic hemiparesis, an extensor plantar response on the right, and paralysis of the lower two-thirds of his face on the right. His speech is fluent, and he has normal comprehension of both verbal and written commands.

Sample Set: Neuroanatomy

- A. Left anterior cerebral artery
- B. Left posterior cerebral artery
- C. Left middle cerebral artery
- D. Left lenticulostriate arteries
- E. Right anterior cerebral artery
- F. Right posterior cerebral artery
- G. Right middle cerebral artery
- H. Right lenticulostriate arteries

For each patient with neurologic abnormalities, select the artery that is most likely to be involved.

1. A 72-year-old right-handed man has weakness and hyperreflexia of the right lower limb, an extensor plantar response on the right, normal strength of the right arm, and normal facial movements.

Ans: A

2. A 68-year-old right-handed man has right spastic hemiparesis, an extensor plantar response on the right, and paralysis of the lower two-thirds of his face on the right. His speech is fluent, and he has normal comprehension of verbal and written commands.

Ans: G