UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

CPT114 – Logic & Application
[Logik & Aplikasi]

Duration : 3 hours
[Masa : 3 jam]

INSTRUCTIONS TO CANDIDATE:
[ARAHAN KEPADA CALON:]

- Please ensure that this examination paper contains **THREE** questions in **NINE** printed pages before you begin the examination.

  *[Sila pastikan bahawa kertas peperiksaan ini mengandungi **TIGA** soalan di dalam **SEMBILAN** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

- Answer **ALL** questions.

  *[Jawab **SEMUA** soalan.]*

- You may answer the questions either in English or in Bahasa Malaysia.

  [Anda dibenarkan menjawab soalan sama ada dalam bahasa Inggeris atau bahasa Malaysia.]

- In the event of any discrepancies, the English version shall be used.

  [Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi bahasa Inggeris hendaklah diguna pakai.]

1. (a) Multiple choice questions. Select the best answer.

Soalan pelbagai pilihan. Pilih jawapan yang terbaik.

(i) In correct reasoning,

(A) all of the propositions are true.
(B) the truth of the premises guarantees the truth of the conclusion.
(C) the conclusion is never false.
(D) the conclusion supports the premises.

(ii) "If undergraduate education in the Humanities is to be successful, students must take courses in a broad range of areas including history, literature, philosophy, and art."

This is an example of:

(A) an argument.
(B) a disjunctive proposition.
(C) a conditional proposition.
(D) none of the above.

(iii) "(1) Lawns need constant maintenance, so (2) busy people should hire someone to take care of them. (3) I like a nicely kept lawn."

Which sentence is the conclusion?

(A) Sentence (1).
(B) Sentence (2).
(C) Sentence (3).
(D) There is no conclusion.

(iv) "The word home means 'that place where, when you have to go there, they have to take you in.'"

This definition is best described as a:

(A) stipulative definition.
(B) precising definition.
(C) theoretical definition.
(D) lexical definition.

(v) "No logic problems are valuable experiences."
"Some logic problems are valuable experiences."

How are these two propositions related?

(A) They are contradictories.
(B) They are contraries.
(C) They are corresponding propositions—super- or subalterns.
(D) They are subcontraries.

(vi) In the Boolean interpretation of propositional logic:

(A) subalternation is no longer valid.
(B) A and I propositions are no longer contraries.
(C) the square of opposition is rescued by making the existential presupposition.
(D) universal propositions have existential import.

(vii) "No children are soldiers; some males are soldiers; therefore, some males are not children."

Which term in this standard-form syllogism is the middle term?

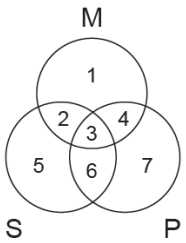
(A) children.
(B) soldiers.
(C) males.
(D) therefore.

(viii) "Some logic professors are not good speakers. All logic professors are individuals who have nice suits. Therefore, no individuals with nice suits are good speakers."

What is the mood of this standard-form syllogism?

(A) OAO.
(B) AOA.
(C) AOE.
(D) OAE.

(ix) Given the following syllogism,



No M are P.
<u>All S are M.</u>
No S are P.

After filling in the Venn diagram,

(A) Areas 3, 4, 5, and 6 are shaded.
(B) Areas 1, 2, and 3 are shaded.
(C) Areas 3, 4, and 5 only are shaded.
(D) Areas 2, 3, 6, and 7 are shaded.

(x) For the syllogism in problem (ix), the correct answer from the Boolean standpoint is:

(A) Invalid, existential fallacy.
(B) Invalid, illicit major.
(C) Valid, no fallacy.
(D) Invalid, undistributed middle.

(10/100)

(b) For each argument, determine whether or not it is valid. If the argument is not valid, describe the steps to make it valid.

Bagi setiap hujah, tentukan sama ada ia adalah sah atau tidak. Jika hujah tersebut tidak sah, terangkan langkah-langkah untuk menjadikannya sah.

(i) If Jane has a cat, then Jane has a pet.
Jane has a pet.
Therefore, Jane has a cat.

(ii) If Jane has a cat, then Jane has a pet.
It is not the case that Jane has a pet.
Therefore, it is not the case that Jane has a cat.

(iii) If Jane has a cat, then Jane has a pet.
It is not the case that Jane has a cat.
Therefore, it is not the case that Jane has a pet.

(iv) If P, then Q.
_____
If not Q, then not P.

(v) Either P or Q.
Not P.
_____
Q.

(vi) If P, then Q.
If R, then Q.
_____
If P, then R.

(6/100)

(c) Use diagramming technique to analyse the following argument.

Gunakan teknik gambar rajah untuk menganalisis hujah berikut.

Government mandates for zero-emission vehicles would not work because only electric cars qualify as zero-emission vehicles, and electric cars would not sell. They are too expensive, their range of operation is too limited, and recharging facilities are not generally available.

(4/100)

(d) (i) Based on the Square of Opposition and the Immediate Inferences, assume the proposition in Step 1 is true, show the changes of each proposition from Step 2 until Step 7. Determine the truth values, "T" for true, "F" for false, or "U" for undeterminable for each of the step.

Berdasarkan "Square of Opposition" dan "Immediate Inferences", dengan membuat anggapan bahawa usul dalam Langkah 1 adalah benar, tunjukkan perubahan setiap usul daripada Langkah 2 hingga Langkah 7. Tentukan nilai kebenaran, "T" untuk benar, "F" untuk palsu, atau "U" untuk tidak dapat ditentukan bagi setiap langkah tersebut.

1. No meaningful statements are non-intelligible.
2. Obverse of 1
3. Converse of 1
4. Contrapositive of 2
5. Contradictory of 4
6. Subcontrary of 5
7. Subaltern of 3

(ii) You cannot see what is inside a box, but are told that it contains coloured shapes. In each of the following questions, suppose the given sentence is the only information you have about the coloured shapes in the box. Determine whether the other sentences are true (T) or false (F). If the truth value cannot be determined, identify it as undetermined (?).

Anda tidak boleh melihat apa yang ada di dalam kotak, tetapi diberitahu bahawa ia mengandungi bentuk-bentuk berwarna. Dalam setiap soalan-soalan berikut, katakan kenyataan yang diberikan adalah satu-satunya maklumat yang anda tahu tentang bentuk-bentuk berwarna dalam kotak. Tentukan sama ada kenyataan-kenyataan lain adalah benar (T) atau palsu (F). Jika nilai kebenaran tidak dapat ditentukan, nyatakan sebagai tidak dapat ditentukan (?).

(A) Given "Some squares are blue."

All squares are blue.
No squares are blue.
Some squares are not blue.

(B) Given "It is false that all octagons are grey."

No octagons are grey.
Some octagons are grey.
Some octagons are not grey.

(9/100)

(e) The figure of a standard categorical syllogism is determined by the positions of the two appearances of the middle term. Which of the following syllogisms is/are not valid in the fourth figure?

Bentuk untuk "syllogism" kategori piawai ditentukan oleh kedudukan kedua-dua istilah pertengahannya. "Syllogism" di bawah yang manakah adalah tidak sah dalam bentuk keempat?

AEE IAI EIO OAO

Test and explain each syllogism using Venn Diagram to show whether it is valid or invalid.

Uji dan terangkan setiap "syllogism" dengan gambar rajah Venn untuk menunjukkan sama ada ia adalah sah atau tidak sah.

Name the fallacy of the invalid syllogism.

Namakan kesilapan untuk "syllogism" yang tidak sah.

(6/100)

2. (a) Fill in the blank with the best answer.

Isi ruang kosong dengan jawapan yang tepat.

(i) A _____ does not contain any other statement as a component.

(ii) Two statements are _____ if the statement of their material equivalence is a tautology.

(2/100)

(b) Write the specific form of the following rules of inference.

Tulis bentuk spesifik bagi peraturan kesimpulan berikut.

(i) Modus Tollens

(ii) Hypothetical Syllogism

(3/100)

(c) Provide a truth table of material equivalence.

Sedia jadual kebenaran bagi kesetaraan isi.

(2/100)

(d) Use a truth table to decide the following biconditional is tautology.

Guna jadual kebenaran untuk menentukan pernyataan dwisyarat adalah tautologi.

$$a \equiv [a \bullet (b \vee \sim b)]$$

(5/100)

(e) Construct a formal proof of validity using the rules of inference for each of the following arguments.

Bina bukti formal kesahihan dengan menggunakan peraturan kesimpulan bagi setiap hujah berikut:

(i) $1.A \supset B$
$2.B \supset C$
$3. \sim C$
$\therefore \sim A \bullet \sim B$

(ii) $1.Z \supset B$
$2.B \supset C$
$3.C \supset Z$
$4.Z \supset \sim C$
$\therefore \sim Z \bullet \sim C$

(10/100)

(f) Prove the invalidity for the following argument by assigning a correct truth values.

Buktikan ketaksahan bagi hujah yang berikut dengan meletakkan nilai-nilai kebenaran yang betul.

$1.(x)(Ax \supset \sim Bx)$
$2.(x)(Ax \supset \sim Cx)$
$\therefore (x)(Cx \supset \sim Bx)$

(3/100)

(g) Construct a formal proof of validity using the rules of inference for the following arguments.

Bina bukti formal kesahihan dengan menggunakan peraturan kesimpulan bagi setiap hujah berikut.

$$1.(x)[Px \supset (Ex \vee Ux)]$$
$$2.(\exists x)(Px \bullet \sim Ux)$$
$$\therefore (\exists x)(Ex \bullet Px)$$

(10/100)

3. (a) Given the following passage:

Diberi petikan berikut:

Joshua, Bill and Tom are males. Greg and Tom are smokers. Joshua and Tom are vegetarians. Sophie could date anyone if they are male and non-smokers. Sophie could date anyone if they are male and vegetarian.

Joshua, Bill dan Tom ialah lelaki. Greg dan Tom ialah perokok. Joshua dan Tom ialah vegetarian. Sophie boleh temu janji dengan sesiapapun sekiranya mereka ialah lelaki dan bukan perokok. Sophie boleh bertemu janji dengan sesiapapun sekiranya mereka ialah lelaki dan vegetarian.

(i) Using suitable relations, translate each of the above sentences into Prolog facts and rules.

Dengan menggunakan hubungan yang sesuai, terjemahkan setiap ayat di atas ke dalam fakta dan petua Prolog.

(8/100)

(ii) Based on the facts and rules in question 3(a)(i) above, write a Prolog query to find out who is the possible date for Sophie.

Berdasarkan fakta dan petua dalam soalan 3(a)(i) di atas, tulis pertanyaan Prolog untuk mencari siapa yang berkemungkinan menjadi pasangan temu janji Sophie.

(2/100)

(iii) What is the Prolog output in question 3(a)(ii)?

Apakah output Prolog dalam soalan 3(a)(ii)?

(2/100)

(b) Given the following knowledge base on river networks:

Diberi pangkalan pengetahuan tentang rangkaian sungai seperti berikut:

```
tributary(linggi,pahang).
tributary(kolok,linggi).
tributary(cerating,endau).
tributary(bebar,linggi).
tributary(endau,pahang).
tributary(jelai,kolok).
tributary(mercung,jelai).
```

(i) Write a Prolog recursive rule called `drains_to` that indicates whether a river flows into another river. For example, given the following Prolog query:

```
?- drains_to(jelai,pahang).
```

Prolog will reply `'yes'`.

Tulis petua rekursi Prolog dipanggil `drains_to` yang menentukan sama ada suatu sungai mengalir ke sungai yang berikutnya. Sebagai contoh, diberi pertanyaan Prolog berikut:

```
?- drains_to(jelai,pahang).
```

Prolog akan menjawab `'yes'`.

(5/100)

(ii) Draw the search tree for the following Prolog query:

Lukis pohon gelintaran untuk pertanyaan Prolog berikut:

```
?- drains_to(jelai,pahang).
```

(5/100)

(c) Write a Prolog program called `last` that prints the last element in a given list.

For example, Prolog returns `e` because it is the last element in the list of `[a,b,c,d,e]`.

```
? – last ([a,b,c,d,e]).
    Last element is : e
```

Tulis atur cara Prolog dipanggil `last` yang mencetak elemen terakhir dalam sesuatu senarai.

Sebagai contoh, Prolog mengembalikan `e` kerana ia elemen terakhir dalam senarai `[a,b,c,d,e]`.

```
? – last ([a,b,c,d,e]).
    Last element is : e
```

(8/100)