UNIVERSITI SAINS MALAYSIA

First Semester Examination
2015/2016 Academic Session

December 2015/January 2016

CPT114 – Logic & Applications
[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) Write down whether each of the following statement is **TRUE** or **FALSE**. If any statement is FALSE, indicate the change to be done in order to make it TRUE:

(i) In correct reasoning, the conclusion is never false.

(ii) The process of arriving at and affirming one proposition on the basis of one or more other propositions is called interpretation.

(iii) "Either cigarette smoking in eating establishments should be banned or these establishments should have designated smoking areas."
This is a conditional proposition.

(iv) An invalid deductive argument is one in which, if the premises are true, the conclusion could be false.

(v) Diagramming involves laying out the structure of the argument in two-dimensional spatial relations.

(vi) In analyzing an argument one must not ignore authorial intent.

(vii) A stipulative definition reports a meaning that a definiendum already has.

(viii) The figure of a syllogism is determined by the position of the middle term in its premises.

(ix) Categorical propositions are false if their quality is negative.

(x) The obverse of "No sofas are chairs" is "No chair is a sofa".

(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.

(i) If you get enough money, you can buy a new car.
You can buy a new car.
Therefore, you have got enough money.

(ii) If the weather is good, we can go to the beach.
The weather is not good.
Therefore, we cannot go to the beach.

(iii) The cafeteria food is acceptable or appalling.
The cafeteria food is acceptable.
Therefore, the cafeteria food is not appalling.

(6/100)

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

(i) Rome was able to maintain control over its vast empire because it had well-trained soldiers and could deploy them quickly on well-made roads.

(ii) At one time Gary Kasparov had the highest ranking of any chess grandmaster in history. However, he was beaten in a chess tournament by a computer program called Deep Blue, so the computer program should be given a ranking higher than Kasparov.

(6/100)

(d) For each categorical proposition, identify the subject and predicate term. Name the quality, quantity, quantifier and state whether the subject and predicate terms are distributed or undistributed. Then, represent the proposition using a Venn diagram.

(i) All professors of philosophy are psychopaths in need of immediate medication.

(ii) Some passengers on large jet airplanes are not satisfied customers.

(8/100)

(e) Write out four syllogistic forms for AEE using S and P as the subject and predicate terms and M as the middle term.

Test and explain each syllogistic form using Venn diagram with example classes (e.g. artist, actors, rich people, liars, etc.) to show whether it is valid or invalid.

(10/100)

2. (a) Provide a truth table and conclusion based on the following statement.

$$\sim (\mathrm{a} \vee \mathrm{b}) \overset{\mathsf{T}}{\equiv} (\sim a \bullet \sim b)$$

(5/100)

(b) Using the truth table for each of the following statement forms, find whether it is a tautology, self-contradictory or contingent form:

(i) $(p \bullet q) \supset (p \vee \sim q)$

(ii) $(p \supset p) \vee (q \bullet \sim q)$

(iii) $[p \supset (q \supset \mathrm{r})] \vee [(p \supset q) \supset (p \supset r)]$

(9/100)

(c) Construct a formal proof of validity, using the rules of inference, for each of the following arguments:

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

(ii) $1.A \supset B$
$2.(A \bullet B) \supset C$
$3.(A \bullet C) \supset D$
$\therefore A \supset D$

(iii) If the first disjunct of a disjunction is true, the disjunction as a whole is true. Therefore if both the first and second disjuncts of the disjunction are true, then the disjunction as a whole is true.

(14/100)

(d) Translate each of the following into the logical notation of propositional functions and quantifiers. Use the abbreviations given in brackets and make each formula begin with a quantifier, not with a negation symbol:

(i) Snakes bites are sometimes fatal (Sx: x is a snake bites; Fx: x is fatal).

(ii) Not any applicant was hired (Ax: x is an applicant; Hx: x was hired).

(4/100)

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

1. (x) (A$x \supset \sim$Dx)
2. $(\exists x)(Cx \bullet Ax)$
$\therefore (\exists x)(Cx \bullet \sim Dx)$

(8/100)

3. (a) Given the following facts in a Prolog program:

```
person(ammar, male, 24).
person(fatimah, female, 15).
person(lee, male, 17).
person(may, female, 15).
person(jane, female, 22).
person(fred, male, 25).
```

(i) Write a query to find anyone whose age 15 years old.

(ii) Write a predicate called `match`, which matches any male in his twenties with any female in her twenties.

(6/100)

(b) Write a predicate called `power(N,Pow)` that finds the value of two to the power of N.

For example:

```
?- power(3, Pow).
Pow = 8
```

This is because 2 x 2 x 2 is 8.

(7/100)

(c) Write a predicate called `sumList(N, Sum)` that sums all the integers in a list of integers, `N`.

For example:

```
?- sumList([1,2,3], Sum).
   Sum = 6
```

This is because 1 + 2 + 3 is 6.

(7/100)

1. (a) Nyatakan sama ada setiap pernyataan berikut adalah **BENAR** atau **PALSU**. Jika jawapan untuk pernyataan adalah PALSU, kemukakan perubahan yang perlu dilakukan untuk menjadikan pernyataan tersebut BENAR:

   (i) *In correct reasoning, the conclusion is never false.*

   (ii) *The process of arriving at and affirming one proposition on the basis of one or more other propositions is called interpretation.*

   (iii) *"Either cigarette smoking in eating establishments should be banned or these establishments should have designated smoking areas."*
   This is a conditional proposition.

   (iv) *An invalid deductive argument is one in which, if the premises are true, the conclusion could be false.*

   (v) *Diagramming involves laying out the structure of the argument in two-dimensional spatial relations.*

   (vi) *In analyzing an argument one must not ignore authorial intent.*

   (vii) *A stipulative definition reports a meaning that a definiendum already has.*

   (viii) *The figure of a syllogism is determined by the position of the middle term in its premises.*

   (ix) *Categorical propositions are false if their quality is negative.*

   (x) *The obverse of "No sofas are chairs" is "No chair is a sofa".*

   (10/100)

   (b) Untuk setiap hujah berikut, tentukan sama ada hujah itu adalah sah atau tidak. Jika hujah adalah tidak sah, terangkan langkah-langkah untuk menjadikannya sah.

   (i) *If you get enough money, you can buy a new car.*
   You can buy a new car.
   Therefore, you have got enough money.

   (ii) *If the weather is good, we can go to the beach.*
   The weather is not good.
   Therefore, we cannot go to the beach.

   (iii) *The cafeteria food is acceptable or appalling.*
   The cafeteria food is acceptable.
   Therefore, the cafeteria food is not appalling.

   (6/100)

(c) Guna teknik rajah untuk menganalisiskan hujah-hujah berikut.

(i) *Rome was able to maintain control over its vast empire because it had well-trained soldiers and could deploy them quickly on well-made roads.*

(ii) *At one time Gary Kasparov had the highest ranking of any chess grandmaster in history. However, he was beaten in a chess tournament by a computer program called Deep Blue, so the computer program should be given a ranking higher than Kasparov.*

(6/100)

(d) Untuk setiap proposisi pengelasan, kenal pasti terma subjek dan terma predikat. Namakan kualiti, kuantiti, pengkuantiti dan nyatakan sama ada terma subjek dan terma predikat adalah diagihkan atau tidak diagihkan. Kemudian, wakilkan proposisi dengan menggunakan gambar rajah Venn.

(i) *All professors of philosophy are psychopaths in need of immediate medication.*

(ii) *Some passengers on large jet airplanes are not satisfied customers.*

(8/100)

(e) Tuliskan empat bentuk silogistik AEE dengan menggunakan S dan P sebagai terma subjek dan terma predikat dan M sebagai terma tengah.

Uji dan terangkan setiap bentuk silogistik melalui gambar rajah Venn dengan menggunakan contoh kelas-kelas (seperti artis, pelakon, orang kaya, orang yang berdusta, dan lain-lain) untuk menunjukkan sama ada ia sah atau tidak sah.

(10/100)

2. (a) Sediakan jadual kebenaran dan kesimpulan berdasarkan pernyataan yang berikut:

$$\sim (\mathrm{a} \vee \mathrm{b}) \overset{\mathsf{T}}{\equiv} (\sim a \bullet \sim b)$$

(5/100)

(b) Dengan menggunakan jadual kebenaran bagi setiap bentuk pernyataan berikut, cari sama ada ia adalah tautologi, bercanggah atau bentuk kontingen:

(i) $(p \bullet q) \supset (p \vee \sim q)$

(ii) $(p \supset p) \vee (q \bullet \sim q)$

(iii) $[p \supset (q \supset \mathrm{r})] \vee [(p \supset q) \supset (p \supset r)]$

(9/100)

(c) Bina bukti formal kesahihan, dengan menggunakan peraturan kesimpulan, bagi setiap hujah-hujah berikut:

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

(ii) $1.A \supset B$
$2.(A \bullet B) \supset C$
$3.(A \bullet C) \supset D$
$\therefore A \supset D$

(iii) Sekiranya disjungsi pertama adalah benar, disjungsi secara keseluruhannya adalah benar. Maka oleh yang demikian sekiranya kedua-dua disjungsi yang pertama dan kedua adalah benar, maka disjungsi secara keseluruhannya adalah benar.

(14/100)

(d) Terjemahkan setiap yang berikut ke dalam notasi logik fungsi dan pengkuantiti usulan. Gunakan singkatan yang diberikan dalam kurungan dan tulis setiap formula bermula dengan pengkuantiti, bukan dengan simbol penafian:

(i) *Snakes bites are sometimes fatal (*Sx*: *x* is a snake bites;* Fx*: *x* is fatal)*.

(ii) *Not any applicant was hired (*Ax*: *x* is an applicant;* Hx*: *x* was hired)*.

(4/100)

(e) Bina bukti formal kesahihan, dengan menggunakan peraturan kesimpulan, bagi hujah berikut:

1. $(x)\ (\mathrm{A}x \supset \sim \mathrm{D}x)$
2. $(\exists x)(Cx \bullet Ax)$
$\therefore (\exists x)(Cx \bullet \sim Dx)$

(8/100)

3. (a) Diberi fakta berikut dalam atur cara Prolog:

```
person(ammar, male, 24).
person(fatimah, female, 15).
person(lee, male, 17).
person(may, female, 15).
person(jane, female, 22).
person(fred, male, 25).
```

(i) Tulis pertanyaan untuk mencari sesiapa yang berumur 15 tahun.

(ii) Tulis predikat dipanggil `match`, yang memadankan mana-mana lelaki dalam lingkungan umur dua puluhan dengan mana-mana wanita dalam lingkungan umur dua puluhan.

(6/100)

(b) Tulis predikat dipanggil `power(N,Pow)` yang mencari nilai dua kuasa N.

Sebagai contoh:

```
?- power(3, Pow).
Pow = 8
```

Ini kerana 2 x 2 x 2 ialah 8.

(7/100)

(c) Tulis predikat dipanggil `sumList(N, Sum)` yang menjumlahkan semua nilai integer dalam senarai `N` yang mengandungi nombor integer.

Sebagai contoh:

```
?- sumList([1,2,3], Sum).
   Sum = 6
```

Ini kerana 1 + 2 + 3 ialah 6.

(7/100)