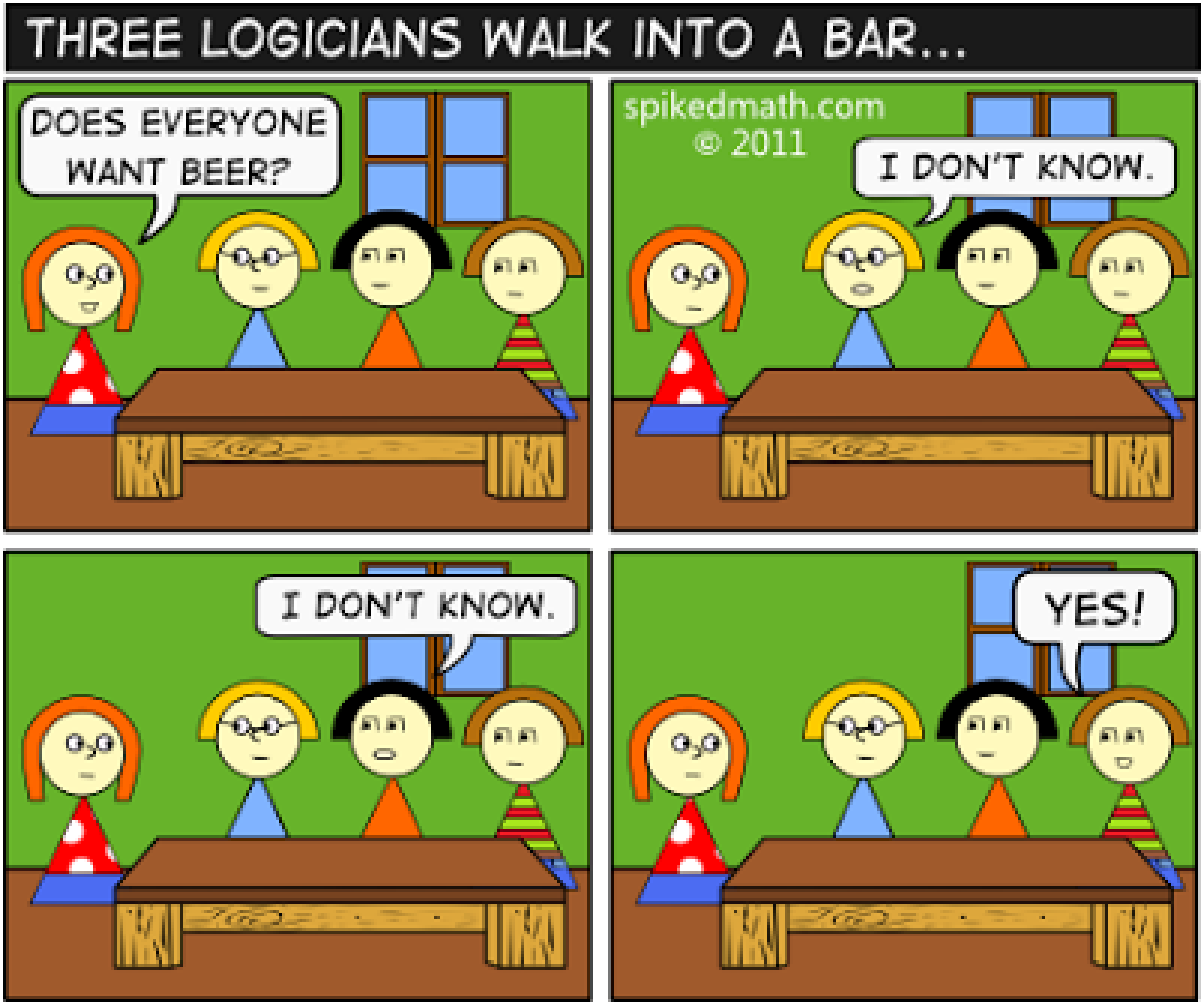
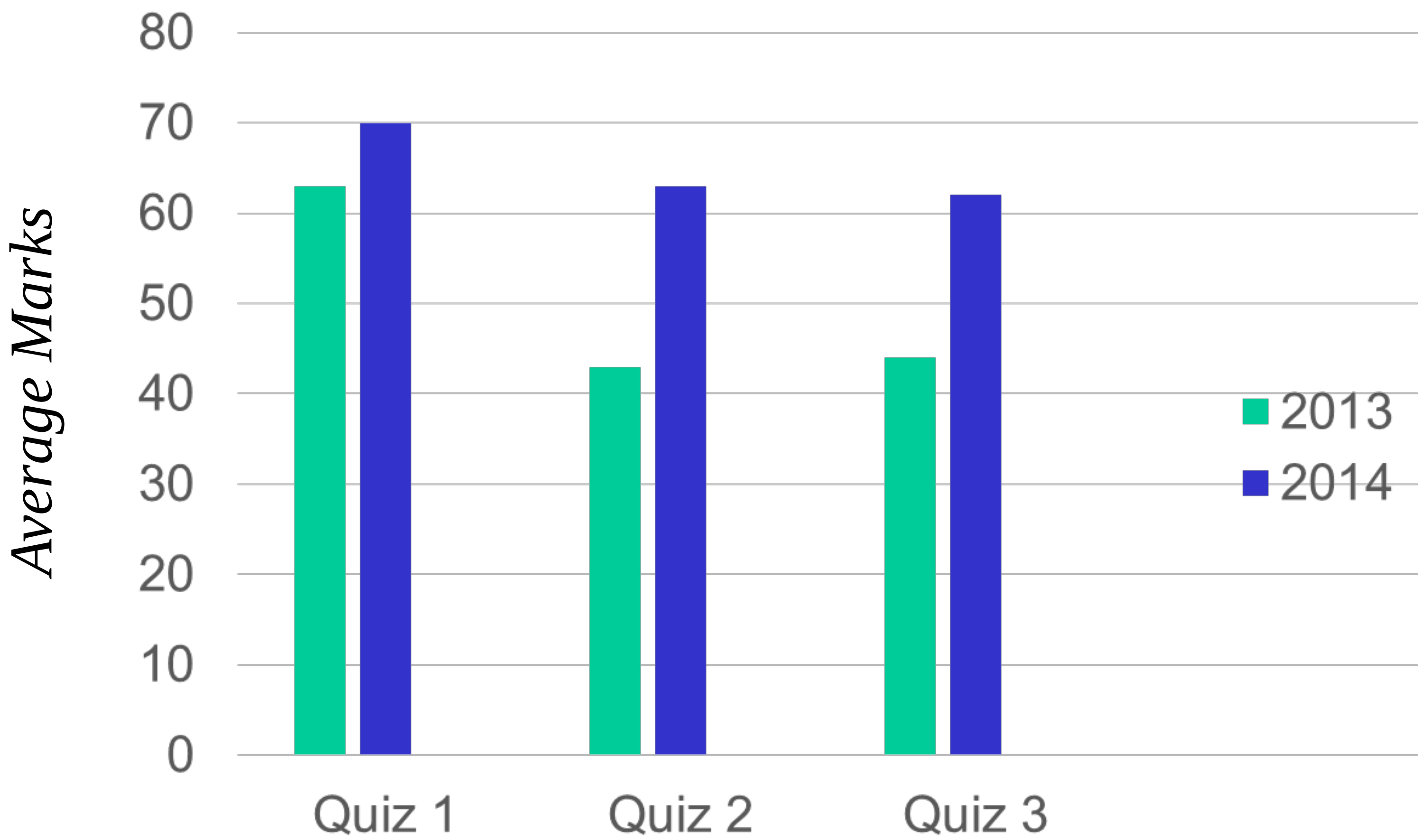
COM1002: Foundations of Computer Science



WEEK	4	5	6	7
Mon	Lecture **Handout Ex 3** (Assessed 5%)	Lecture **Hand in Ex 3** **Handout Ex4**	Lecture	Lecture **Handout Ex5** (Assessed 5%)
Wed	Lecture	Lecture	**Revision Lecture**	Lecture
Thurs	Tut (ex 3)	Tut (ex 4)	Tutorial (Revision) **QUIZ 1 (25%)** Diamond 101 4pm-5:30pm	Tut (ex 5)

WEEK	8	9	10	11
Mon	Lecture **Hand in Ex 5** **Handout Ex6** (Assessed 5%)	Lecture **Hand in Ex 6**	Lecture **Hand out ex 7** (Assessed 5%)	**Revision Lecture** **Hand in Ex 7**
Wed	Lecture	**Revision Lecture**	Lecture	**Revision Lecture**
Thurs	Tut (ex 6)	**Revision Tutorial** **QUIZ 2 (25%)** Diamond 101 4pm-5:30pm	Tut (ex 7)	**Revision Tutorial** **QUIZ 3 (25%)** Diamond 101 4pm-5:30pm

Quiz Results 2013, 2014



Dr Watton begins lecturing COM1002 from 2014…
Hopefully 2015 can be as successful or more successful than 2014

Update from 2014…

Previously given as 2 hour lectures. Update to two 1 hour lectures per week.

Dedicated Revision lecture/tutorial before each MOLE Quiz

More practise questions of similar style to those encountered on MOLE quizzes

Lecture notes updated for first time last year – some mistakes crept in – these were addressed before the lecture notes handed out but led to negative feedback. (However, do mistakes help people to engage?)

Challenging material – I will try to make it as interesting and engaging as possible. Lecture notes are being updated again.

Warm up!

Universe of Discourse

The universe of discourse, universal set, is the set of entities over which certain variables of interest in some formal treatment may range.

Existential quantification

$$\exists x P(x)$$

The existential quantifier always means “at least one”, which means that there may be one or more of the specified thing in existence.

Unique existential quantification

$$\exists! x P(x)$$

Sometimes, it may be useful to say that there is only one. In these cases, an existential quantifier is written as ∃!, which means "there exists exactly one"

Universal quantification

$$\forall x P(x)$$

In predicate logic, a **universal quantification** is a type of **quantifier**, which is interpreted as "for all". It expresses that a propositional function can be satisfied by every member of a domain of discourse.

Existential quantification

Let the Universe of Discourse be the Set of first year students on COM1002

Let L(x) denote ‘x likes Brussel sprouts’

NB: Overseas students:

Eating Brussel sprouts is a strange English tradition at Christmas time which involves eating a vegetable nobody likes.

What do the following Predicate expressions mean ?

$$\exists x L(x) \qquad \exists x \neg L(x)$$

$$\neg \exists x \neg L(x) \qquad \neg \exists x L(x)$$

Universal quantification

Let L(x) denote ‘x likes Brussel sprouts’

What do the following Predicate expressions mean ?

$$\forall x L(x)$$

$$\forall x \neg L(x)$$

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Let the Universe of Discourse be the Set of first year students on COM1002

Let M(x) denote ‘x likes Marmite on toast’

Express with predicates:

Some students like marmite on toast.

All students like marmite no toast.

No students like marmite on toast.

Exactly one student likes marmite on toast

Exactly two students like marmite on toast.

Let the Universe of Discourse be the Set of students at Sheffield University.
Let L(x,y) denote 'x loves y (where x is not equal to y)'

$\exists x \exists y L(x, y)$ ***A student loves another student***

$\forall x \forall y L(x, y)$ ***Every student loves all other students***

$\exists x \exists y [L(x, y) \wedge L(y, x)]$ ***Two students are in love with one another***

$\exists x \exists y [L(x, y) \wedge \neg L(y, x)]$ ***For two students, love is not reciprocated.***

$$\exists x \exists y \exists z [L(x, y) \wedge L(y, z) \wedge L(z, x) \wedge \neg L(y, x) \wedge \neg L(z, y) \wedge \neg L(x, z)]$$

Life is complicated

The Frog Puzzle

The Frog Puzzle

$F(x)$: x is a frog

$G(x)$: x is green

$K(x)$: x is called Kermit

1. All frogs are green.
2. Some frogs are green.
3. Not all frogs are green.
4. Some frogs are not green.
5. No frogs are green.
6. All frogs are not green.
7. Only frogs are green.
8. All and only frogs are green.
9. Kermit is a green frog.

Express the above statements with Predicate Logic.

The Frog Puzzle

1. All frogs are green.
2. Some frogs are green.
3. Not all frogs are green.
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5. No frogs are green.
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9. Kermit is a green frog.

$$\neg\forall x\left[F(x) \Rightarrow G(x)\right]$$

$$\forall x\left[G(x) \Leftrightarrow F(x)\right]$$

$$\exists x\left[F(x) \wedge G(x)\right]$$

$$\neg\exists x\left[F(x) \wedge G(x)\right] \quad \forall x\left[F(x) \Rightarrow G(x)\right] \quad \exists x\left[F(x) \wedge \neg G(x)\right]$$

$$\exists x\left[F(x) \wedge K(x)\right] \quad \forall x\left[G(x) \Rightarrow F(x)\right] \quad \forall x\left[F(x) \Rightarrow \neg G(x)\right]$$

Not all frogs are green. $\neg\forall x\left[F(x) \Rightarrow G(x)\right]$

Some frogs are not green. $\exists x\left[F(x) \wedge \neg G(x)\right]$