National Student Survey 2026

How to take part?

thestudentsurvey.com

YOU CAN COMPLETE THE SURVEY ONLINE

The NSS respects student privacy. At no point will students be identified to their university or college; your responses are kept strictly confidential and are anonymised

YOUR VIEWS, YOUR NSS.

Ipsos

What is the NSS?

Annual survey aimed at final year undergraduates across the UK

The survey is your opportunity to feedback on your learning experience

Your views inform prospective student choices and help universities and colleges improve the student experience

It is easy to complete

Student responses are anonymous to universities and colleges

The NSS opens on 3 February 2026

The survey is delivered by Ipsos, and independent research company, on behalf of the UK funding and regulatory bodies

What does the survey ask?

The NSS questions relate to the following aspects of the student experience:

- Teaching on my course
- Learning opportunities
- Assessment and feedback
- Academic support
- Organisation and management
- Workload
- Learning resources
- Student voice
- Student Union

Why should you take part?

An opportunity to give your views about your student experience

Help shape the future of your course for current and prospective students

The NSS results have inspired many universities and colleges to make significant changes, including improving library provision and resourcing

Your responses will remain anonymous to your university or college

Your feedback will help prospective students choose where and what to study at university or college

If you enter the survey you could win a £100 voucher

What happens to the results?

Your feedback is used to improve the learning experience for students like you

1

NSS results are made available to prospective students at DiscoverUni.gov.uk, a source of information and guidance for prospective students on higher education in the UK

2

NSS results will be published on the OfS website, however anonymised student comments are not published

3

Detailed and anonymised NSS results are given back to universities and colleges. Universities and colleges use the anonymised results to identify what is going well, where improvements can be made and to enhance the overall learning experience for current and future students

More information

thestudentsurvey.com

#YourViewsYourNSS

X: @NSS_Ipsos

Visit: www.thestudentsurvey.com

Email: thestudentsurvey@ipsos.com

Introduction to Quantum Programming and Semantics

Lecture 10: ZX Calculus

Chris Heunen

University of Edinburgh

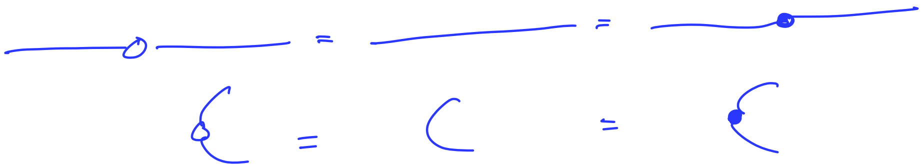
Overview

- ZX Calculus
- Soundness
- Completeness
- Quantum circuits
- Automation

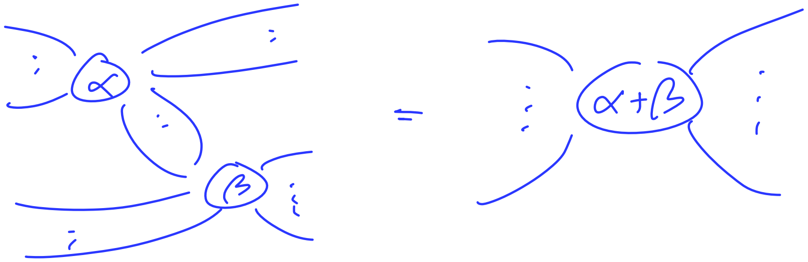
ZX calculus

Rules

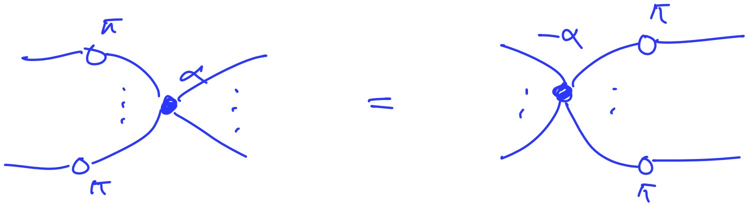
• wire rules: only connectivity matters



• spider

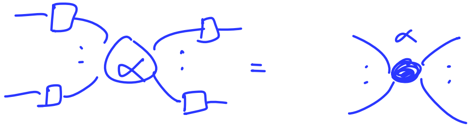


• π rule:

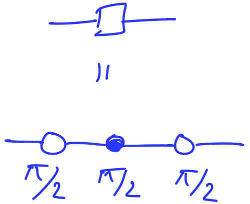


Rules

· colour change:

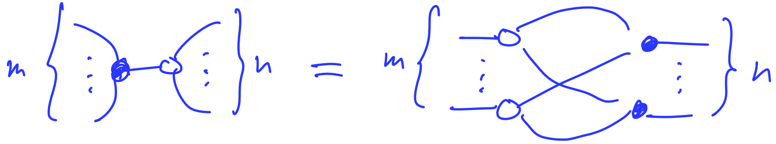


where



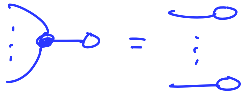
· strong complementarity

"complete (m,n)-bipartite graph"



special case m=0:

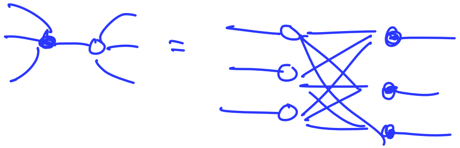
n=0:



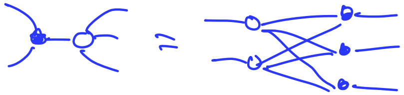
m=n=2

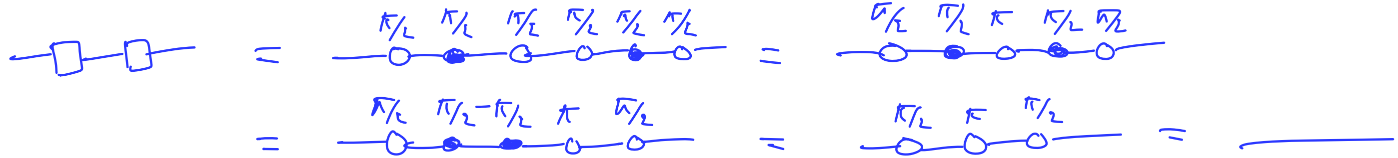
"bialgebra law"

m=n=3:



m=2, n=3:

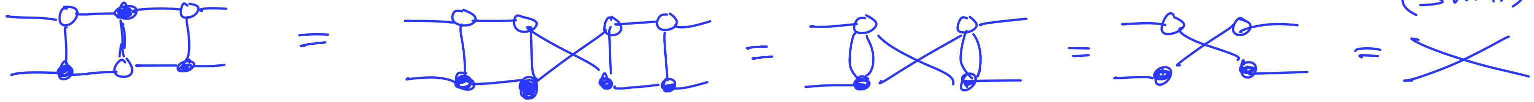


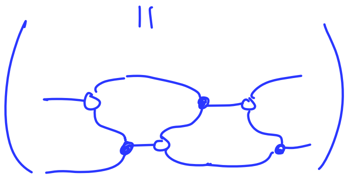


Lem:

(3 CNOTs)

(SWAP)

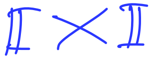




Soundness

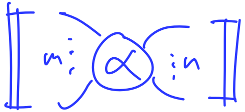
Semantics

$$= \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

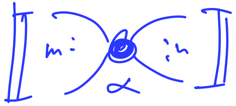


$$= \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

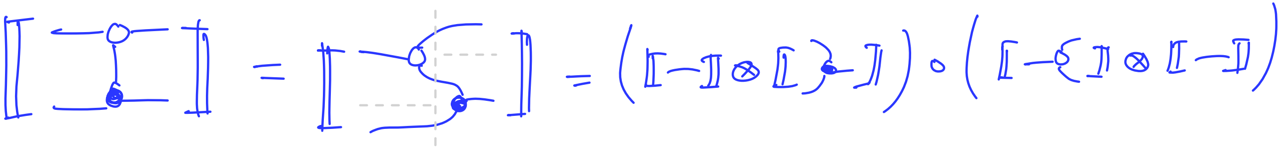
$$= \begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$



$$= |\underbrace{0 \cdots 0}_{n}\rangle\langle\underbrace{0 \cdots 0}_{m}| + e^{i\alpha}|\underbrace{1 \cdots 1}_{n}\rangle\langle\underbrace{1 \cdots 1}_{m}| = \overbrace{\begin{pmatrix} 1 & & & \\ & 0 & & 0 \\ & & \ddots & \\ 0 & & 0 & \\ & & & e^{i\alpha} \end{pmatrix}}^{2^m} \Big\} 2^n$$

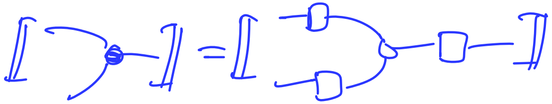
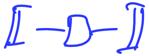


$$= |\underbrace{+ \cdots +}_{n}\rangle\langle\underbrace{+ \cdots +}_{m}| + e^{i\alpha}|\underbrace{- \cdots -}_{n}\rangle\langle\underbrace{- \cdots -}_{m}|$$



$$= \left(\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \otimes \begin{pmatrix} 2 & 0 & 0 & 2 \\ 0 & 2 & 2 & 0 \end{pmatrix} \Big/ 2 \right) \circ \left(\begin{pmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 1 \end{pmatrix} \otimes \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right)$$

$$= \begin{pmatrix} 2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 & 2 & 2 & 0 \end{pmatrix} \Big/ 2 \circ \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 2 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 2 \\ 0 & 0 & 2 & 0 \end{pmatrix} \Big/ 2$$

(check that  where  $= \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} / \sqrt{2}$)

Completeness

Universality

Thm: any n-qubit unitary can be constructed from only single qubit gates and CNOT gates

Cor: any n-qubit unitary is the interpretation of some ZX diagram

Approximate universality

Thm: for any n-qubit unitary U and $\varepsilon > 0$,

there exist a ZX diagram d s.t.

- $\| U - [\![d]\!] \| < \varepsilon$
- d only uses phases multiples of $\pi/8$

Completeness

<u>thm:</u> if d, d' are ZX diagrams, then:

matrices $[\![d]\!] = [\![d']\!]$ are equal

$\Longrightarrow$

$\exists$ legal rewrite from d to d'

(needs: $\forall \alpha, \beta, \gamma \ \exists \alpha', \beta', \gamma'$: 

)

↳ in terms of sin/cos of α, β, γ

Automation

Quantomatic, PyZX, QuiZX, ZX live

Summary:

- ZX calculus is sound and complete
- ZX calculus is universal
- $\pi/4$-ZX calculus is approximately universal
- ZX rewriting can be automated