Swansea University
Prifysgol Abertawe

CIE 2022

SWANSEA 11-15 JULY

Revolutions and Revelations in Computability

SWANSEA UNIVERSITY

Swansea University's history goes back to 1920. Its first campus, the Singleton Campus, is located in a lovely setting by the sea, right next to one of the biggest parks in Swansea. The second campus, the Bay Campus, was opened in 2015. Lying between the Bay Campus and Neath Estuary is our very own nature reserve, Crymlyn Burrows, which we certainly recommend visiting during your stay. The dunes, saltmarsh and beach are protected as a Site of Special Scientific Interest (SSSI).

In 2018 the doors to the Computational Foundry, the home of the departments of Computer Science and Mathematics, were opened. We are proud to host this year's CiE conference here.

INVITED SPEAKERS

ERIKA ÁBRAHÁM
RWTH AACHEN UNIVERSITY

THIERRY COQUAND
UNIVERSITY OF GOTHENBURG

LIESBETH DE MOL
UNIVERSITY OF LILLE

DAMIR DZHAFAROV
UNIVERSITY OF CONNECTICUT

HARVEY M. FRIEDMAN
THE OHIO STATE UNIVERSITY

SVETLANA SELIVANOVA
KAIST

TUTORIAL SPEAKERS

NOAM GREENBERG
VICTORIA UNIVERSITY OF WELLINGTON

RECENT INTERACTIONS BETWEEN COMPUTABILITY AND SET THEORY

Since very early days, there has been a certain overlap between computability theory and set theory: one can view both fields as inhabiting two parts of a spectrum that starts with regular languages and polynomial-time computation, continues with partial computable functions and Turing reducibility, and then the hyperarithmetic realm, effective descriptive set theory, fine structure of the constructible hierarchy, and inner models for large cardinals. Thus the same diagonal argument was used by Cantor for the unctounability of the reals, by Gödel for the incompleteness theorem, and by Turing for the undecidability of the halting problem.
I plan to survey three areas which have seen recent activity: higher randomness, uncountable structures and effective Borel sets.

DORA GIAMMARRESI
UNIVERSITÀ DI ROMA TOR VERGATA

TWO-DIMENSIONAL LANGUAGES AND MODELS

A picture, defined as a rectangular array of symbols chosen from a given alphabet, is the two-dimensional counterpart of a string. Researchers were inspired by the attempt to reproduce Chomsky's hierarchy for picture languages. In the past and more so in recent years, the classical methods used to define string languages have been essayed for picture languages, thus obtaining various formal models and picture language families.
The tutorial presents the state of the art of formal definitions for picture languages. The formal models considered are: 2D regular expressions, tiling systems, automata and grammars of different types. Each picture language family will be presented by means of typical examples that illustrate its expressiveness. Moreover each 2D formal model will be compared with the corresponding string model to point out similarities and differences. The two-dimensional perspective will show up with its intrinsic richness whose we will analyze drawbacks and benefits.

Computability in Europe 2022

Programme Overview

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00	Registration				
9:30	Coquand	Dzhafarov	Ábrahám	Selivanova	Special Sessions
10:00					
10:30	Coffee				
11:00	Greenberg			Special Sessions	Coffee
11:30					Contributed talks
12:00	Lunch				
12:30					
13:00					BBQ
13:30	De Mol	Giammarresi	Friedman	Giammarresi	
14:00					Special Sessions
14:30	Coffee				
15:00	Contributed talks		Optional Excursion & Dinner @ 19:00	Special Sessions	
15:30					Closing
16:00					
16:30	Coffee			Coffee	
17:00	Contributed talks	WiC		ACiE Meeting	
17:30					
18:00					

Invited Talk
Tutorial

All events, except for Excursion & Dinner, take place in the Computational Foundry on Bay Campus.

Monday 11 July 2022

9:00	Registration at the Foyer of the Computational Foundry		
9:30	*Thierry Coquand:* Sheaf Cohomology in Univalent Foundation		
10:30	**Coffee**		
11:00	*Noam Greenberg*: Recent interactions between computability and set theory		
12:00	**Lunch**		
13: 30	*Liesbeth De Mol:* Towards a diversified understanding of computability or Why we should care more about our histories		
14:30	**Coffee**		
	RRR	**LH**	**BR**
15:00	*Vedran Čačić, Marko Horvat and Zvonko Iljazović* Computable subcontinua of semicomputable chainable Hausdorff continua	*Juvenal Murwanashyaka* Weak Sequential Theories of Finite Full Binary Trees	*Paul Shafer and Sebastiaan A. Terwijn* Ordinal analysis of partial combinatory algebras
15:30	*Zvonko Iljazović and Lucija Validžić* Computably categorical subspaces of Euclidean space	*Anupam Das and Avgerinos Delkos* Proof complexity of monotone branching programs	*Merlin Carl* Lower bounds on $\beta(\alpha)$ and other properties of α-ITRMs
16:00	*Pierre Pradic and Giovanni Soldà* Additive and ordered Ramsey theorems in the Weihrauch degrees	*Lauri Hella and Miikka Vilander* Defining long words succinctly in FO and MSO	*Victor Selivanov* Boole vs Wadge: Comparing Two Basic Tools of Descriptive Set Theory
16:30	**Coffee**		
	RRR	**LH**	**BR**
17:00	*Manon Blanc and Olivier Bournez* A characterization of polynomial time computable functions from the integers to the reals using discrete ordinary differential equations	*Ingo Blechschmidt and Peter Schuster* Maximal ideals in countable rings, constructively	*Nikolay Bazhenov, Vittorio Cipriani and Luca San Mauro* Calculating the mind-change complexity of learning algebraic structures
17:30	*Eike Neumann* On Envelopes and Backward Approximations	*Sam Sanders* Reverse Mathematics of the uncountability of *R*	*Vanja Doskoč and Timo Kötzing* Maps of Restrictions for Behaviourally Correct Learning

All plenary talks take place in the Robert Recorde Room (RRR – 102); Coffee and lunch breaks take place in the Crucible – 109
LH – Lecture Hall 002; BR – Board Room 401; TL – Theory Lab 209; MRR – Math Reading Room – 320

Tuesday 12 July 2022

9:30	*Damir Dzhafarov:* Reverse Mathematics 2021			
10:30	**Coffee**			
11:00	*Noam Greenberg:* Recent interactions between computability and set theory			
12:00	**Lunch**			
13:30	*Dora Giammarresi:* Two-dimensional Languages and Models			
14:30	**Coffee**			
	RRR	**MRR**	**BR**	**TL**
15:00	*Josiah Jacobsen-Grocott* The failure of Selman's Theorem for hyperenumeration reducibility	*Samuele Maschio and Pietro Sabelli* On the compatibility between the Minimalist Foundation and Constructive Set Theory	*Augusto Modanese* Sublinear-Time Probabilistic Cellular Automata — and a Connection to Sliding-Window Algorithms	*Samira Attou, Ludovic Mignot, Clément Miklarz and Florent Nicart* Monadic Expressions and their Derivatives
15:30	*Bjørn Kjos-Hanssen and David Webb* Strong Medvedev reducibilities and the Kolmogorov-Loveland randomness problem	*Iosif Petrakis and Daniel Wessel* Algebras of complemented subsets	*Marcella Anselmo, Manuela Flores and Maria Madonia* Fun Slot Machines and Transformations of Words avoiding Factors	*Michał Gajda* Computational philosophy of science
16:00	*Keng Meng Ng, Frank Stephan, Yue Yang and Liang Yu* On Trees without Hyperimmune Branches	*Michał Gajda* Consistent ultrafinitist logic	*Muhammad Usama Sardar and Christof Fetzer* Intel's Specification of Trust Domain Extensions (TDX) Remote Attestation: colossal mistake or company policy?	*William Stirton* Barendregt's Problem #26 and Combinatory Strong Reduction
16:30	**Coffee**			
17:00	Women in Computability (until 18:30) Speakers: *Dora Giammarresi and Troy Astarte*			

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Wednesday 13 July 2022

9:30	*Erika Ábrahám:* SMT Solving: Historical review and new developments
10:30	**Coffee**
11:00	*Noam Greenberg:* Recent interactions between computability and set theory
12:00	**Lunch**
13:30	*Harvey M. Friedman:* String Replacement Systems
14:30	**Coffee**
15:00	Optional Excursion & Dinner at Worms Head Hotel @ 19:00

Excursion to Gower

Our excursion is to **Rhossili** on the Gower Peninsula. You'll see a 2.8-mile (4.5 km) wide sandy beach backed with sand dunes. Some locals refer to the beach as Llangennith Sands. Behind the beach just north of the village is Rhossili Down with the highest point on the Gower Peninsula, the Beacon (193 metres), and a number of prehistoric remains.

At the southern end of the Rhossili Bay is Worm's Head, consisting of two tidal islands: Outer Head 184 feet (56 m) and Inner Head 154 feet (47 m). At the north is Burry Holms. These islands are accessible only at low tide.

Rhossili Bay featured in the Opening Ceremony of the London 2012 Olympic Games; a youth choir began a cappella performances of "Bread of Heaven" live on the beach which was broadcast at the Olympic Stadium. The bay has been used as the setting of New Earth in the sci-fi show Doctor Who and the bay including the Old Rectory was used in Torchwood: Miracle Day. In 2014, it was voted the UK's number one beach, third best in Europe, and 9th best in the world, by TripAdvisor users. (Wikipedia)

The conference dinner will take place at the Worms Head Hotel, overlooking Rhossili Bay and Worms Head.

Photo credit: Rodw, CC 3.0

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Thursday 14 July 2022

9:30	*Svetlana Selivanova:* Computational Complexity of Classical Solutions of Partial Differential Equations		
10:30	**Coffee**		
	RRR ***At the intersection of computability and other areas of mathematics***	**LH** ***Computing with bio-molecules***	**BR** ***Computability theory of blockchain technology***
11:00	*Bjørn Kjos-Hanssen* An incompressibility theorem for automatic complexity	*Giuditta Franco* DNA library evidence strings	*Eli Ben-Sasson* Ultra Scaling Blockchains with ZK-STARKs
11:45	*Elvira Mayordomo* Algorithmic dimensions, the point-to-set principles, and the complexity of oracles	*Daria Pchelina, Nicolas Schabanel, Shinnosuke Seki and Guillaume Theyssier* Turedo a new computational model for molecular nanobots?	Panel discussion
12:30	**Lunch**		
13:30	*Dora Giammarresi:* Two-dimensional Languages and Models		
14:30	**Coffee**		
	RRR ***Constructive and reverse mathematics***	**LH** ***Reachability problems***	**BR** ***Computing Language: Love Letters, Large Models and NLP***
15:00	*Huishan Wu* Reverse Mathematics and Semisimple Rings	*Kitty Meeks* Reducing reachability in temporal graphs: towards a more realistic model of real-world spreading processes	*Jacopo Tagliabue* Are we there yet? Meaning in the age of large language models
15:45	*Robert Lubarsky* On the Necessity of Some Topological Spaces	*Oliver Bournez* Programming with Ordinary Differential Equations: Some First Steps Towards a Programming Language	*Maël Pégny* Are Large Language Models Models (of Language)?
16:30	**Coffee**		
17:00	ACiE Meeting (until 18:00)		

All plenary talks take place in the Robert Recorde Room (RRR – 102); Coffee and lunch breaks take place in the Crucible – 109
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Friday 15 July 2022

	RRR ***Constructive and reverse mathematics***	LH ***Reachability problems***	BR ***Computing Language: Love Letters, Large Models and NLP***	
09:30	*Makoto Fujiwara* An extension of the equivalence between Brouwer's fan theorem and weak Koenig's lemma with a uniqueness hypothesis	*Véronique Bruyère* A Game-Theoretic Approach for the Automated Synthesis of Complex Systems	*Troy Astarte* 'My avid fellow feeling' and 'Fleas': Playing with words on the computer	
10:15	*Takayuki Kihara* Computability Theory and Reverse Mathematics via Lawvere-Tierney topologies	*James Worrell* The Skolem Landscape	*Juan Luis Gastaldi* Mathematics as Natural Language: Principles, Consequences and Challenges of the Application of NLP Models to the Treatment of Mathematical Knowledge	
11:00	**Coffee**			
	RRR	**LH**	**BR**	**TL**
11:30	*Juvenal Murwanashyaka* Hilbert's Tenth Problem for Term Algebras with a Substitution Operator	*Matea Čelar and Zvonko Iljazović* Computable type of certain quotient spaces	*Nikolay Bazhenov and Maxim Zubkov* Well-orders realized by c.e. equivalence relations	*Valerii Sopin* PH vs PSPACE
12:00	*Wai Lok Cheung* Dissolution of the halting problem: a recognition conception of decision procedure	*Matthew de Brecht, Takayuki Kihara and Victor Selivanov* Enumerating Classes of Effective Quasi-Polish Spaces	*Andreas Weiermann* The phase transition for Harvey Friedman's monotone Bolzano Weierstrass principle	
12:30	**Lunch**			
	RRR ***At the intersection of computability and other areas of mathematics***	LH ***Computing with bio-molecules***	BR ***Computability theory of blockchain technology***	
14:00	*Meng-Che Ho, Julia Knight and Russell Miller* A computable functor from torsion-free abelian groups to fields	*María Dolores Jiménez-López* Processing natural language with biomolecules: where linguistics, biology and computation meet	*Philip Wadler* Smarter contracts: Applications of Haskell and Agda at IOG	
14:45	*Alexandra Shlapentokh* A connection between Inverse Galois Problem of a field and its first-order theory	*Petr Sosík* Computability and complexity in morphogenetic systems	*Maurice Herlihy* Blockchains and Related Technologies: Which Ideas Are Likely to Endure?	
15:30	Closing Remarks			

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SPECIAL SESSIONS

AT THE INTERSECTION OF COMPUTABILITY AND OTHER AREAS OF MATHEMATICS

Organisers:

- **Denis Hirschfeldt (University of Chicago)**
- **Karen Lange (Wellesley College)**

Speakers:

- **Meng-Che Ho (California State University Northridge)**
- **Alexandra Shlapentokh (Eastern Carolina University)**
- **Elvira Mayordomo (Universidad de Zaragoza)**
- **Bjørn Kjos-Hanssen (University of Hawai`i at Mānoa)**

COMPUTABILITY THEORY OF BLOCKCHAIN TECHNOLOGY

Organisers:

- **Arnold Beckmann (Swansea University)**
- **Anton Setzer (Swansea University)**

Speakers:

- **Eli Ben-Sasson (StarkWare)**
- **Maurice Herlihy (Brown University, Providence)**
- **Philip Wadler (University of Edinburgh)**

There will also be a panel discussion with the speakers of this special session.

COMPUTING LANGUAGE: LOVE LETTERS, LARGE MODELS AND NLP

Organisers:

- **Liesbeth de Mol (Université de Lille)**
- **Giuseppe Primiero (University of Milan) for the Council of the HaPoC Commission**

Speakers:

- **Troy Astarte (Swansea University)**
- **Juan-Luis Gastaldi (ETH Zürich)**
- **Maël Pégny (Universität Tübingen)**
- **Jacopo Tagliabue (COVEO)**

SPECIAL SESSIONS

COMPUTING WITH BIO-MOLECULES

Organisers:

- **Jérôme Durand-Lose (Université d'Orleans)**
- **Claudio Zandron (University of Milan Bicocca)**

Speakers:

- **Giuditta Franco (University of Verona)**
- **Maria Dolores Jimenez-Lopez (University of Tarragona)**
- **Nicolas Schabanel (CNRS - LIP, Ecole Normale Supérieure de Lyon)**
- **Petr Sosik (Silesian University of Opava)**

CONSTRUCTIVE AND REVERSE MATHEMATICS

Organisers:

- **Samuele Maschio (Universita di Padova)**
- **Takako Nemoto (Hiroshima Institute of Technology)**

Speakers:

- **Makoto Fujiwara (Tokyo University of Science)**
- **Takayuki Kihara (Nagoya University)**
- **Robert Lubarsky (Florida Atlantic University)**
- **Huishan Wu (BLCU Beijing)**

REACHABILITY PROBLEMS

Organisers:

- **Paul Bell (Liverpool John Moores University)**
- **Igor Potapov (University of Liverpool)**

Speakers:

- **Kitty Meeks (University of Glasgow)**
- **Olivier Bournez (Ecole Polytechnique de Paris)**
- **Véronique Bruyère (Université de Mons)**
- **James Worrell (University of Oxford)**

PROGRAM COMMITTEE

Marcella Anselmo (University of Salerno)
Veronica Becher (University of Buenos Aires)
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Peter Van Emde Boas (University of Amsterdam)
Andreas Weiermann (Ghent University)
Andreas Wichert (University of Lisbon)

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Chair: Arno Pauly

Troy Astarte	Faron Moller	Olga Petrovska
Arnold Beckmann	Bertie Mueller	Monika Seisenberger
Ulrich Berger	Eike Neumann	Anton Setzer
Tonicha Crook		John Tucker

WIFI

The Swansea University Visitor network is available for visitors and guests of the university who do not have academic accounts/access to eduroam.

Connect to 'SwanseaUni-Visitors'
The first thing you need to do is view the list of available wireless networks on your device and then connect it to the open SwanseaUni-Visitors SSID. Once you are connected you should be prompted to sign-in. If you are not prompted, open a web browser and type in the URL of https://socialwifi.swansea.ac.uk

Log in
After you have connected, you need to log in using either Facebook credentials or your email address. Once you are logged in the window may close, or you will be redirected to the university web site.

COVID

Currently, there are no restrictions regarding COVID 19 on the University premises. However, we recommend to wear face masks indoors.

Please bring your own masks. We have a few masks at the CoFo in case you forget yours.

If you feel unwell, please stay in your hotel and notify us immediately.

You can buy LF Tests (pack of 5, for £9.59) as well as face masks in most pharmacies in Swansea. For example:

Lloyds Pharmacy
Quay Parade
Swansea SA1 8JA
(in Sainsbury's at the River Tawe)
01792 456837
Closes 10 pm

Well Swansea
Beacon Centre for Health
Langdon Rd
Swansea SA1 8QY
(near the Village Hotel)
01792 654635
Closes 6 pm

Superdrug Pharmacy
35/36, The Quadrant
Swansea SA1 3QW
(in the shopping centre,
right in the heart of Swansea)
01792 464653
Closes 5:30 pm

Advice from the Welsh government:
https://gov.wales/coronavirus

SWANSEA CITY DINING

Swansea city centre offers several restaurants and cafes. Here are some options that you might consider:

£-££ Awa Grill House (Middle Eastern):
8-10 College Street, Swansea, SA1 5AE
http://awagrillhouse.restaurantwebx.com

£-££ Turkish Kitchen (Turkish):
21 High St, Swansea SA1 1LF
https://www.swanseaturkishkitchen.com

£-££ Panshee (Indian):
29 Singleton St, Swansea SA1 3QN
https://www.pansheeswansea.co.uk

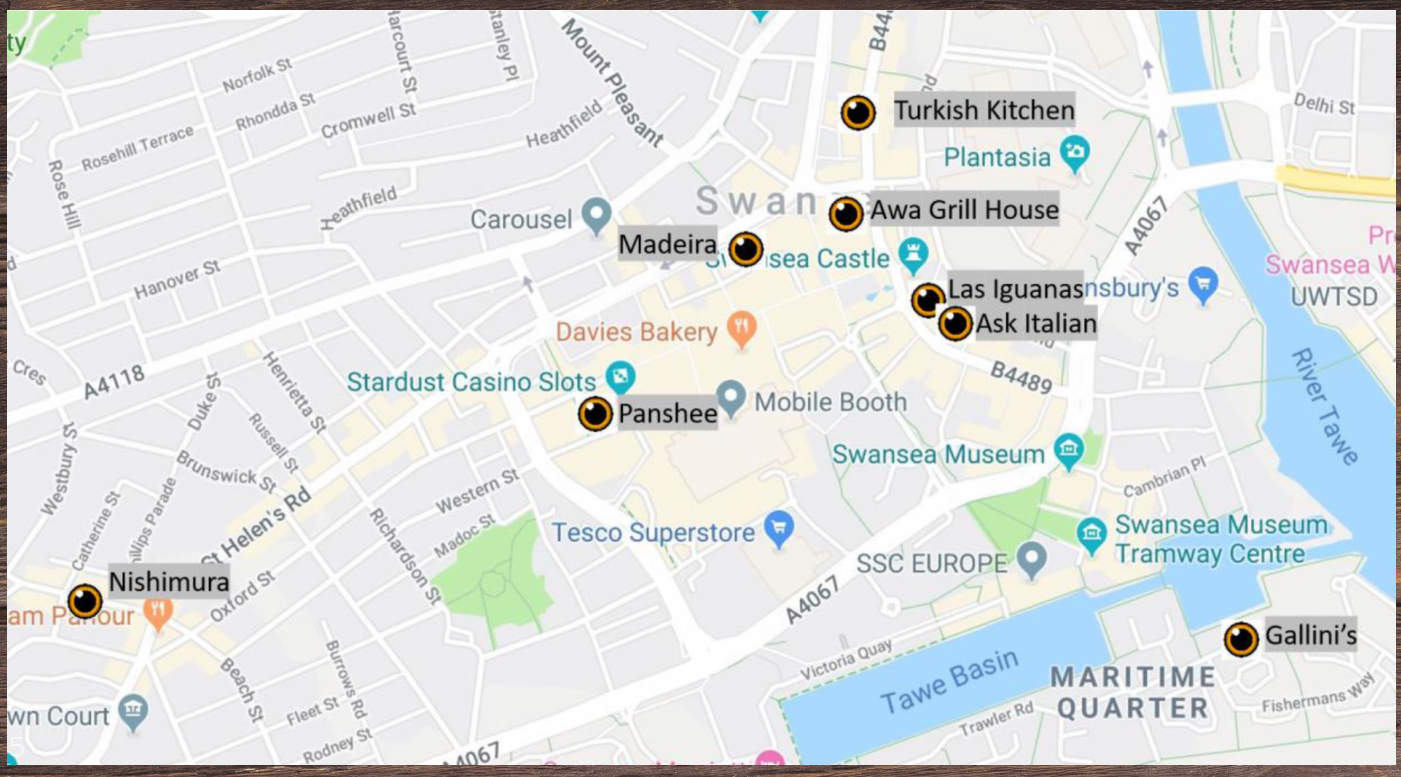
££ Nishimura (Japanese):
83 Brynymor Road, Swansea, SA1 4JE
https://nishimura.co.uk

££ Ask Italian (Italian, Mediterranean):
6 Wind Street, Swansea, SA1 1DF
https://www.askitalian.co.uk

££ Las Iguanas (Mexican, Latin American):
1-4 Castle Square, Swansea, SA1 1DN
https://www.iguanas.co.uk

££-£££ Gallini's (Italian):
Unit 3, Fishmarket Quay, SA1 1UP
http://www.gallinisrestaurant.co.uk

££-£££ Madeira (Portuguese):
46 Kingsway, Swansea, SA1 5HG
https://www.madeirarestaurantswansea.co.uk



Campws y Bae Prifysgol Abertawe

Swansea University Bay Campus

P1	Maes Parcio Ymwelwyr (Talu ac Arddangos) Visitors Car Park (Pay and Display)
P2	Meysydd Parcio Staff Staff Car Park
	Lleoedd Parcio i'r Anabl Disabled Parking Spaces
	Arosfannau Bysiau Bus Stops
	Tacsis Taxis
CP	Parc Beicio Cycle Park
£	ATM
	Beiciau Santander Santander Cycles
	Siopau Shop
	Cwrt Bwyd Food Court
	Bar/Caffi Bar/Café
	Caffi Café
	Peiriannau Gwerthu Vending
	Cawodydd Showers
	Diffibriliwr Defibrillator
	Derbynfa Chwaraeon/ Neuadd/Campfa Sports Reception/Hall/ Gym
	Cyfleusterau Newid Babi Baby Changing Facilities
	Yr Hafan (Canolfan Ffydd) The Haven (Faith Centre)
	Golchdy Launderette
U	Undeb Myfyrwyr Students' Union
MUGA	Cyfleusterau Chwaraeon Awyr Agored Outdoor Sports Facilities
	Ystafelloedd Ymarfer Cerdd Music Practice Rooms
SSSI	Safle o Ddiddordeb Gwyddonol Arbennig Site of Special Scientific Interest
P	Maes Parcio'r Safle o Ddiddordeb Gwyddonol Arbennig Site of Special Scientific Interest Parking
	Mynedfa Canolfan Wybodaeth y Tŵr TIC Entrance

Adeiladau / Buildings

Sefydliad Ymchwil Diogelwch Ynni	1	Energy Safety Research Institute (ESRI)
ORACLE II	1.1	ORACLE II
Dosbarth Gweithredol	1.2	Active Classroom
Swyddfa Weithredol	1.3	Active Office
CISM	1.4	CISM
Sefydliad Deunyddiau Strwythurol	2	Institute of Structural Materials (ISM)
Adeilad Dwyreiniol Peirianneg	3	Engineering East
Iard Nwyddau	3.1	Service Goods Yard
Adeilad Canolog Peirianneg	4	Engineering Central
Llyfrgell y Bae	5	Bay Library
Y Neuadd Fawr	6	Great Hall
Yr Ysgol Reolaeth	7	School of Management
Y Twyni	7.1	Y Twyni
Undeb Myfyrwyr	7.1	Students' Union
Y Coleg	7.2	The College
Preswylfeydd Myfyrwyr	8,9	Student Residences
Parth Gwaith Nanhyfer	8.12	Nanhyfer Work Zone
Neuadd Rod Jones	8.19	Rod Jones Hall
Canolfan Wybodaeth y Tŵr	9	Tower Information Centre (TIC)
MyUniHub	9	MyUniHub
Gwasanaethau Preswyl	9	Residential Services
Ffowndri Gyfrifiadol	11	Computational Foundry
Adeilad Gogleddol Peirianneg	12	Engineering North

Prifysgol Abertawe
Swansea University

VENUE

Computational Foundry
Swansea University Bay Campus
Crymlyn Burrows
Skewen
Swansea
SA1 8EN

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