University of the West of England
BRISTOL

Faculty of Environment & Technology

Academic Year: 2021- 2022

Module Leader	**:**	**Lyernisha S R**
Module Code	**:**	**UFCFA3-30-1**
Module Title	**:**	**Principles of Computing**
Duration	**:**	**24 hours online**
Examination Opens	**:**	**14th May 2022 - 09:00 am**
Examination Opens	**:**	**15th May 2022 - 09:00 am**

Examination Answer Booklet		**Yes**
Multiple Choice Answer Sheet		**No**
Graph Paper	Type of paper e.g. G3, G14	G3
	Number of sheets per student	0

Details of additional material **supplied by UWE**: To be collected with Answer Booklet (please delete as appropriate)	N/A
Details of approved material **supplied by Student**: To be collected with Answer Booklet (please delete as appropriate)	N/A
University approved Calculator	Yes
Candidates permitted to keep Examination Question Paper	Yes

Section A (60 Marks)

Answer any 6 questions (out of 8) from this section.

A1. Propositional logic

a. Use truth table to verify whether A→ (B→ (A ∧ B)) is a tautology **(5 marks)**

b. Check whether (P→ (P ∧ Q)) ⇔ (P → Q) is a tautology using logical equivalence formula **(5 marks)**

A2. Propositional logic

a. Use logical equivalences and the rules of inference to determine whether the following argument is valid. **(10 Marks)**

{U → R, (R ∧ S) → (P ∨ T), Q → (U ∧ S), ¬T, Q} ⊢ P

1.	U → R	Premise
2.	(R ∧ S) → (P ∨ T)	Premise
3.	Q → (U ∧ S)	Premise
4.	¬T	Premise
5.	Q	Premise
6.	**……**	Assumption for Indirect Proof
7.	U ∧ S	**……**
8.	**……**	7, Simplification
9.	R	**……**
10.	¬T ∧ ¬P	4,6, **……**
11.	¬ (T∨ P)	10, DE Morgan's Law
12.	**……**	2,11 **……**
13.	**……**	7, Simplification
14.	R∧ S	**……**
15.	**……**	11, 14 Contradiction
16.	P	

A3. Predicate logic

a. Let P(x) be the statement "x + 1 > x." What is the truth value of the quantification ∀x.P(x).**(2 Marks)**

b. What is the truth value of ∃x P(x), where P(x) is the statement "$x^2 > 10$" and the universe of discourse consists of the positive integers not exceeding 4? **(2 Marks)**

c. Consider the following interpretation for propositional functions P, Q and with R domain D= {Green, Red, White, Blue, Yellow, Purple}. In parts (i) – (iv) you are given formulae in predicate logic, together with their truth values under this interpretation. You are required to explain why these formulae, have the given truth values.

x	P(x)	Q(x)	R(x)
Green	T	T	F
Red	F	F	T
White	F	F	F
Blue	T	T	F
Yellow	T	F	T
Purple	F	T	T

Explain why, under the above interpretation:

i. Q(Blue)∨(P(Red)↔R(Purple)) is True **(1 Mark)**

ii. ∃x.(P(x)∧R(x)) is True **(2 Marks)**

iii. ∀x.(P(x) → (¬Q(x))) is False **(1 Mark)**

iv. (∀x.Q(x)) → (∃x.R(x)) is True **(2 Mark)**

A4. Sets

a. Using Venn diagrams, verify the following identities.

$\overline{(A \cap B) \cup \bar{B}} = B \cap \bar{A}$ **(6 Marks)**

b. Let A = {a, b}, B = {2, 3}, and C = {c}. Construct each of the following sets.

i. A × B × C. **(2 Marks)**

ii. P((A∩B) UC) **(2 Marks)**

A5. Functions

a. Let f and g be the functions from the set of integers to the set of integers defined by f (x) = x^2 +1 and g(x) = 4x + 1. What is the composition of f and g? What is the composition of g and f? **(4 Marks)**

b. Let f and g be functions from {1, 2, 3, 4} to {a, b, c, d} and from {a, b, c, d} to {1, 2, 3, 4}, respectively, with f (1) = d, f (2) = c, f (3) = a, and f (4) = b, and g(a) = 2, g(b) = 1, g(c) = 3, and g(d) = 2**.** **(6 Marks)**

i. Is f one-to-one? Is g one-to-one?

ii. Is f onto? Is g onto?

iii. Does either f or g have an inverse? If so, find this inverse.

A6. Relations

a. For each of the following relations on the set {1, 2, 3, 4}, decide whether the relation is reflexive, irreflexive, symmetric, and/or transitive. **(8 Marks)**

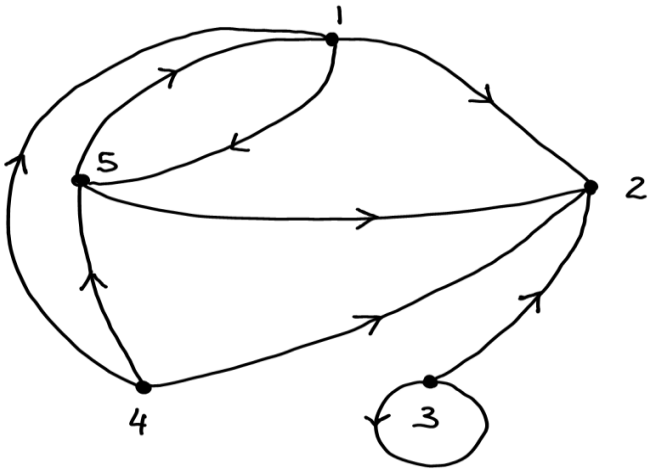
i. {(2,2),(2,3),(2,4),(3,2),(3,3),(3,4) }

ii. {(1,1),(1,2),(2,1),(2,2),(3,3),(4,4) }

iii. {(2,4),(4,2) }

iv. {(1,2),(2,3),(3,4) }

b. Consider the relation W on the set D = {1,2,3,4,5 }, given by the following representation in the form of a directed graph: **(2 Marks)**



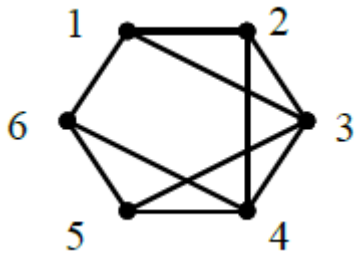
The following statements are all correct. Give an explanation as to the reasons for them to be correct:

i. W is not reflexive.
ii. W is not irreflexive.
iii. W is not symmetric.
iv. W is not transitive.

A7. Graph Theory

a. Draw a graph to represent the relation R = {(a, b), (a, c), (b, c), (c, a)}. **(2 Marks)**

b. Given the following graph G:



i. Find a cycle of length 3. **(1 Mark)**
ii. Find a cycle of length 5. **(1 Mark)**

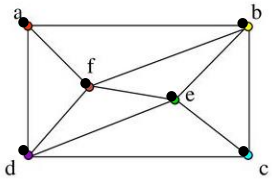
iii. Find a path of length 5 from 1 to 3. **(1 Mark)**

iv. Find the order and degree of the graph **(1 Mark)**

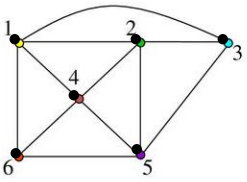
v. Write the Boolean product of the graph **(4 Marks)**

A8. Graph Theory

a. Check whether the following graphs G and G' are isomorphic or not. **(10 Marks)**



G



G'

SECTION B (20*2=40 Marks)

Answer ALL the questions

B1. Convert hexadecimal number 25F into binary and decimal form.

a) 1001011111 – 607
b) 1000000001 – 706
c) 1000010101 – 766
d) 0111110101 – 760

B2. When we construct a FA to accept strings ending with 0, what is the minimum number of states required?

a) 3
b) 2
c) 1
d) can’t be represented.

B3. Language that is constructed from the letters of an alphabet by the Union concatenation and closure are called

a) Context free language
b) Context free Grammar
c) String
d) Regular language

B4. If A = {Λ, a} and B = {Λ ,b}, what is A^2 U A.B? (“U” means union)

a) {a^2, ab}
b) {Λ, a^2, ab}
c) {Λ, a, a^2, ab}
d) {Λ, a, b, a^2, ab}

B5. Suppose A = {a,b,c}, N = {0,1,2,3,4,5,6,7,8,9}, E = {<,>,=}, which of the following is in L = A.N.E.A.N2?

a) a8=b23
b) a0>=c99
c) b<a01

d) b1=c987

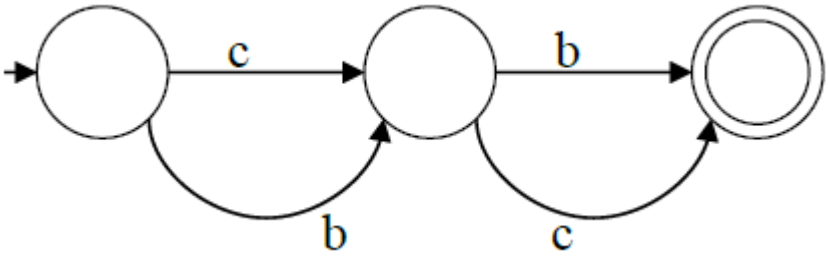
B6. Which of the following statements gives the best description of the relationship between regular languages and Finite Automata?

a) The class of regular languages is exactly the same as the class of languages accepted by Finite Automata.
b) All regular languages can be described by using regular expressions, but some Finite Automata cannot be described by using regular expressions.
c) Some regular languages cannot be recognised by Finite Automata.
d) All regular languages cannot be recognised by Finite Automata.

B7. Which of the following is NOT a characteristics of DFA

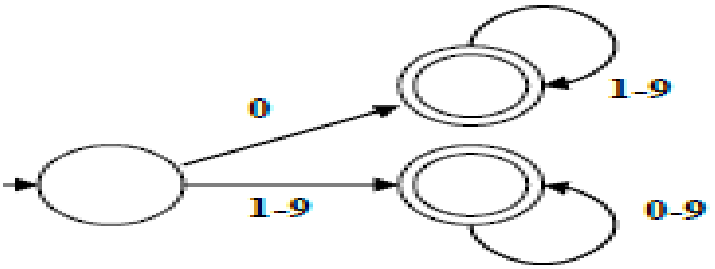
a) Backtracking
b) Difficult to design when compared to NFA
c) One or more final/Halt state
d) One transition for a given input

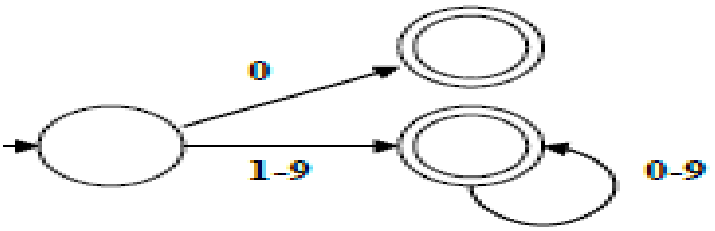
B8. Which of the following languages is defined by this FA?

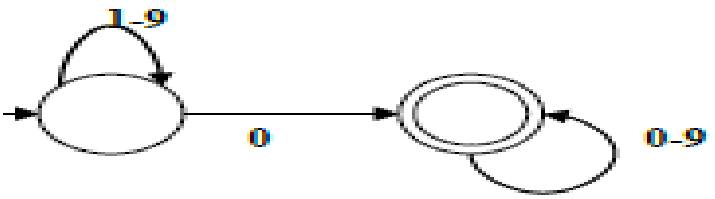


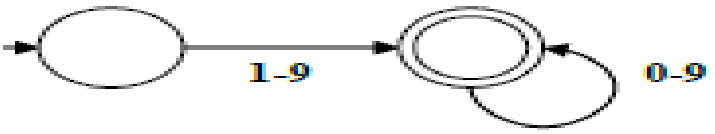
a) { cb, bc }
b) { cc, bb, bc, cb }
c) { c, b, cc, bb }
d) { c, b, cc, bb, cb, bc }

B9. How many the following FAs accept non-negative integers without leading zeros?









a) 4
b) 3
c) 2
d) 1

B10. One of the following deterministic FAs accepts the same language as this non-deterministic FA shown in Fig 1. Which one is it?

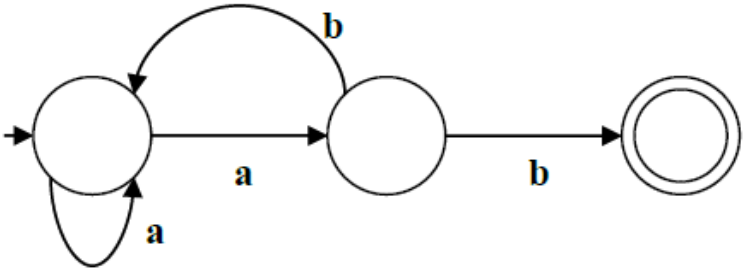
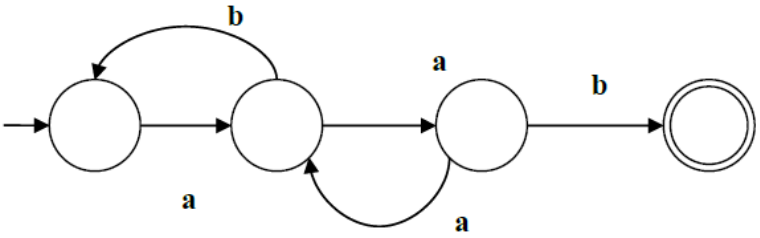
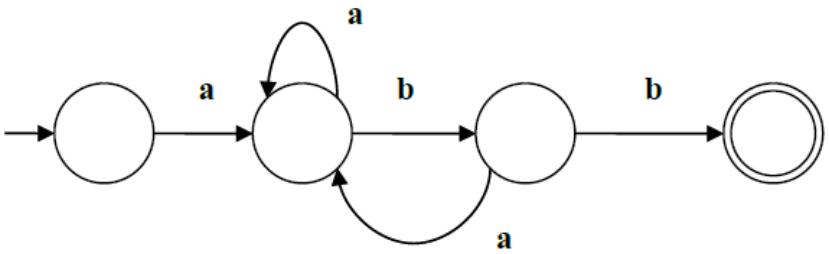


Fig 1. A non-deterministic FA

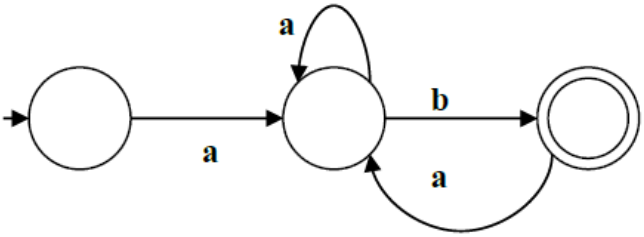
a)



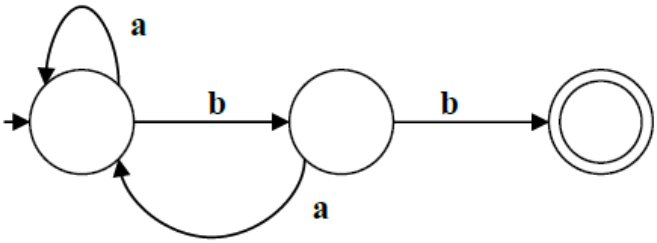
b)



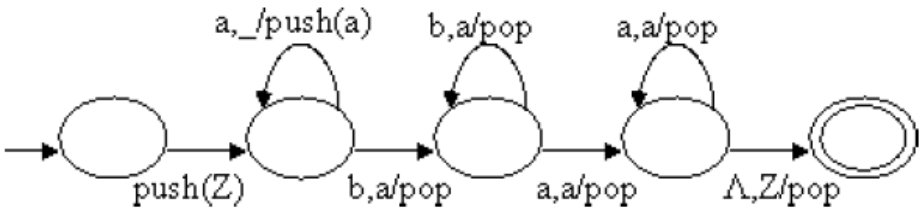
c)



d)



B11. Which of the following language is accepted by this Pushdown Automaton?



a) $\{ a^n b^n a^q \mid n > 1, q > 0 \}$
b) $\{ a^n b^p a^q \mid n > 1, q > 0, p > 0, p = n+q \}$
c) $\{ a^n b^p a^n \mid n > 1, p > 0 \}$
d) $\{ a^n b^p a^q \mid n > 1, q > 0, p > 0, n = p+q \}$

B12. The following four statements describe differences between Finite Automata and Pushdown Automata. Three of them are correct. Which one is incorrect?

a) Finite Automata can only have a finite number of states while Pushdown Automata can have an infinite number of states.
b) Pushdown Automaton = Finite Automaton + a stack
c) Finite Automata cannot count while Pushdown Automata can.
d) In Finite Automata, a transition is represented by 3-tuple, but in Pushdown Automata, a transition is represented by 5-tuple.

B13. Is a Turing machine shown to have a same computation power as a PC?

a) Yes.
b) No, Turing machines are more powerful than PCs because they have unlimited memory space.
c) No, PCs are more powerful than Turing machines are too slow
d) We cannot compare an abstract model with real computers.

B14. In terms of the ‘big-O’ notation what is meant by saying that a program A is ‘more complex’ than another program B.

a) Program A is more complicated than program B.
b) Program A is more efficient than program B.
c) Program A contains more lines than program B does.
d) Program A is less efficient than program B.

B15. Work out what language the following grammar generates.

$S \rightarrow \Lambda$
$S \rightarrow S0$
$S \rightarrow S1$

a) {Λ, 0, 1, 00, 01, 10, 11, 000, 001, 010, 011, 100, 101, 110, 111, 0000, ...}
b) {Λ, 0, 1, 00, 11, 000, 111, 0000, 1111, 00000, 11111 ...}
c) {Λ, 0, 1, 01, 10, 001, 011, 100, 110, 0001, 0011, 0111, 0011, 0111, ...}
d) {Λ, 0, 1, 00, 11}

B16. Find a regular expression to describe the Language L= { Λ, a, abb, abbbb,…,ab^{2n},….}

a) Λ +a(bb)*
b) Λ + $a(bb)^2$
c) $a(bb)^{2n}$
d) Λ +$a(bb)^+$

B17. Find the regular grammar for the regular expression ab*+bc*

a) $S \rightarrow a \mid b$
b) $S \rightarrow a \mid B$, $B \rightarrow \Lambda \mid bB$
c) $S \rightarrow aB \mid bC$, $B \rightarrow \Lambda \mid bB$, $C \rightarrow \Lambda \mid cC$
d) $S \rightarrow \Lambda \mid abS \mid bcS$

B18. Which is a regular expression for the language containing strings with even length over Σ ={a,b}

a) (aa+ab+ba+bb)*
b) (ab)*
c) (a+b)*
d) a*b*

B19. The entity which generates Language is termed as:

a) Automata
b) Tokens
c) Grammar
d) Data

B20. Which of the following strings is not generated by the following grammar? S → SaSbS|e

a) aabb
b) abab
c) aababb
d) aaabb

Please use this answer booklet to write your answers

Villa College

FINAL EXAMINATION

UWE student ID

Program	Intake

Student ID Number								
Learning Centre								
Module Code								
Module Name								
Examination Date				Session	(Morning/Afternoon/Night)			
Examination Venue								

Answer booklet

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