Last/Family Name:
First/Given Name:
Student ID:

UTS UNIVERSITY OF TECHNOLOGY SYDNEY

MATH 37181 FINAL PART A SPRING 2021

INSTRUCTIONS.
- If you don't have a printer or tablet:
  - write your declaration "I declare that: this is my own work ..." at the start of your blank page for Part A;
  - write your answers in the same order and format as this file on blank paper.
- Write your name and student ID on the top of your first page.
- Upload your scan to Canvas - Assignments - Final Exam Part A as a **single PDF file**.
- Name your file using your last-name, student ID number and -PartA, eg: Elder12345678-PartA.pdf
- Show all steps and working out. Clearly identify your answers for the multiple choice. (Eg write A1:F, A2:F, A3:F, A4:F, A5:F on your first page, or circle on a printed page.)
- You may use a basic scientific calculator for calculations. For Question A3 only you may also use the symbolab website.

Part A has **5 multiple choice** and **2 long answer questions** worth a total of 15 marks. You should spend roughly 1 hour on this part.

I declare that: this is my own work, I have not used Discord/Wechat/Facebook etc or asked anyone anything during the exam, I have not posted screenshots or uploaded anything to an online site, I have not used any phone apps except a basic calculator app and Camscanner or other scanning app to scan my work, and I have not looked at any websites other than Canvas to download/upload, and symbolab for Question A3.

(sign your name here) _____

Date: 16 November 2021.

A1. (1 mark) The statement

$$\neg\left(p \vee \neg(q \wedge \neg r)\right)$$

is logically equivalent to

A. $p \wedge (\neg q \wedge \neg r)$

B. $\neg p \wedge (q \vee \neg r)$

C. $\neg p \vee (\neg q \wedge \neg r)$

D. $\neg(p \vee \neg q) \vee \neg r$

E. $\neg(p \vee r) \wedge q$

F. none of (A)–(E).

A2. (1 mark) Consider the function $f : \mathbb{N} \to \mathbb{Z}$ defined by the *recursive* definition [1]

$$\begin{array}{lcll} f(0) & = & 2 & \\ f(1) & = & -1 & \\ f(n) & = & n * f(n-2) & \qquad n > 1. \end{array}$$

The value of $f(7)$ is

A. 96

B. 768

C. -105

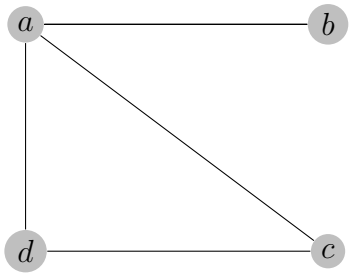
D. -177

E. -420

F. none of (A)–(E).

[1] $*$ means multiplied. Eg $4 * 5 = 20$

A3. (1 mark) Let G be an undirected graph displayed here:



(a) Draw an adjacency matrix for this graph.

(b) The number of paths of length 8 from the vertex labeled a to the vertex labelled b is [2]

A. 45

B. 76

C. 152

D. 197

E. 137

F. none of (A)–(E).

[2]You may use `https://www.symbolab.com/` for this question.

A4. (1 mark) Consider the following fragment of pseudocode:

```
procedure (n int)
temp := 0
for i := 1 to n-1 do
       for j := 1 to i do
              temp := temp + i*j
              print temp
```

On input $n = 10$, how many times is the command `print temp` executed?

A. 55

B. 45

C. 10

D. 100

E. 20

F. none of (A)–(E).

A5. (1 mark) To show that the set theory statement

$$\overline{A} \cap (B \cup C) = (B \cap \overline{A}) \cup C$$

is incorrect, we could use the following example:

A. $\mathscr{U} = \{1, 2, 3, 4, 5\}, A = \{1, 2\}, B = \{3, 4\}, C = \{5\}$

B. $\mathscr{U} = \{1, 2, 3, 4\}, A = \{1, 2\}, B = \{2, 3\}, C = \{4\}$

C. $\mathscr{U} = \{1, 2\}, A = \emptyset, B = \{1\}, C = \{2\}$

D. $\mathscr{U} = \{1, 2, 3, 4\}, A = \{2, 4\}, B = \{1, 3\}, C = \{4\}$

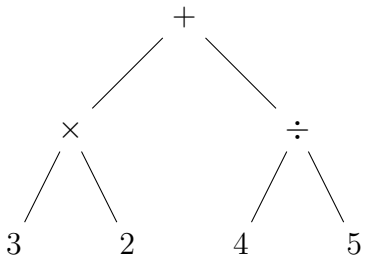
E. $\mathscr{U} = \{1, 2, 3\}, A = \{1\}, B = \{2\}, C = \{3\}$

F. none of (A)–(E).

A6. (5 marks) Prove that $\exists c \in \mathbb{N}$ so that $n! > 20^n$ for all $n \geqslant c$.

A7. (5 marks)

(a) Give the in-order traversal of the following:



(b) Give the tree corresponding to the arithmetic expression $\dfrac{x \times y}{f + 7} - \left(c + \dfrac{z - v}{d}\right)$

(c) Give the post-order traversal of the tree in part (b)

END OF PART A