Final Exam

Due Apr 4 at 6pm   **Points** 25   **Questions** 20   **Available** Apr 4 at 1pm - Apr 4 at 6pm *about 5 hours*
Time Limit 90 Minutes

Instructions

Final Exam

- **Closed book/notes/phones/neighbors**
- Total 25 points
  - There are 20 questions, 5 of which are weighted 2 points and the rest are with 1 point.
- **Open** from Apr. 4, 2020, 1:00 pm
- **Time Limit**: 90 minutes

This quiz was locked Apr 4 at 6pm.

Attempt History

	Attempt	Time	Score
LATEST	**Attempt 1**	90 minutes	20 out of 25

⚠ Correct answers are hidden.

Score for this quiz: **20** out of 25
Submitted Apr 4 at 2:34pm
This attempt took 90 minutes.

Question 1

True or false? Although the particular form of the external storage in PDAs imposes inconvenient limitations on how data can be used after it has been stored, we cannot remove those limitations and achieve another increase in computational power because the external storage in a PDA is with unlimited size.

◉ True

○ False

Question 2

Which of the following statements is *incorrect*?

○ All problems in set NP are solvable in polynomial time

◉ All problems in set P are solvable in polynomial time

○ All problems in set NP are verifiable in polynomial time

○ All problems in set P are verifiable in polynomial time

Question 3

Which of the following is *incorrect* regarding Universality?

○ If removing a particular feature from a machine makes it impossible to write a program that loops forever, it must also have made the machine impossible to be universal

○ Universality has an inconvenient consequence: any system that is powerful enough to be universal will inevitably allow us to construct computations that loop forever without halting

○ Universality is a powerful idea that allows us to use a single adaptable machine for a variety of tasks rather than many specialized devices

◉ Deterministic Turing machines are not universal; nondeterministic Turing machines are universal

Question 4

True or false? PDA can implement algorithms because, in addition to the capabilities that DFAs and NFAs have, PDAs also have the ability to send information back out.

○ True

⦿ False

Question 5

2 / 2 pts

Which of the following statements is *incorrect*?

○ {a}*{b}* is not equivalent to {a,b}*

⦿ {a,b}*{ab}{a,b}*+{b}*{a}* is not equivalent to {a,b}*

○ {a,b}*{ab,bba}{a,b}* represents strings containing ab or bba

○ {a,b}*{aa} represents strings ending in aa

Question 6

1 / 1 pts

True or false? PDAs are more powerful than DFAs mainly because the DFAs have external memory organized as stack that is not randomly addressable.

○ True

○ False

Question 7

1 / 1 pts

True or false? Turing's solution to build a general-purpose machine model was to equip a machine with a blank tape of unlimited length -- effectively a one-dimensional array that can grow at both ends as needed -- and allow it to read and write characters anywhere on the tape.

⦿ True

○ False

Question 8

1 / 1 pts

True or false? An NP-Complete problem is also NP-hard, and an NP-hard problem is also NP-Complete.

○ True

⦿ False

Question 9

Which of the following is *incorrect* regarding Decidability?

○ The halting problem asks whether the execution of a particular Turing machine with a particular initial tape will ever halt.

○ Although program behavior in general is too powerful to be accurately predicted, it is still possible, in principle, to produce bug-free software with the help of software testing.

⦿ The halting problem implicates that it might be mechanically checkable for individual programs, but not in general, thus we will never be able to completely trust machine to do the job for us.

○ It is fundamentally impossible to solve the halting problem, i.e., halting problem is undecidable.

Question 10

Which of the following statements is *incorrect*?

⦿ A single pushdown automaton stack can represent many possible stacks at once.

○ A single state of a finite automaton can be used to represent a combination of many states.

○ Adding nondeterminism does not make a Turing machine more powerful.

○ A single Turing machine tape can be used to store the contents of many tapes.

Question 11

1 / 1 pts

Which of the following statements is incorrect about the below given deterministic finite-state machine?
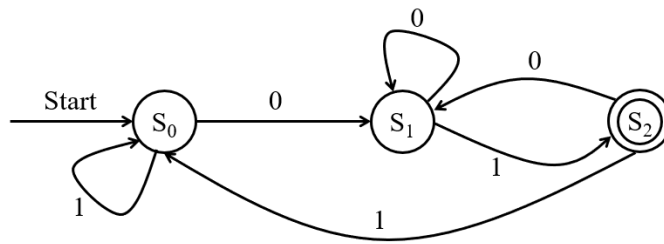
⦿ The string must start with 0 in order to be recognized by this automaton.

○ The string must end in 01 in order to be recognized by this automaton.

○ If the string ends in 0, the string ends in state S1.

○ If the string ends in 11, the string ends in state S0.

Question 12

1 / 1 pts

True or false? PDAs can recognize palindromes, but they cannot recognize doubled-up strings like 'abab' and 'baaabaaa', because once information has been pushed onto a stack, it can only be consumed in reverse order.

- ⦿ True

- ◯ False

Question 13

1 / 1 pts

In PDAs, there is a feedback loop between the rules and the stack – the contents of the stack affect which rules the machine can follow, and following a rule will affect the stack contents – which allows a PDA to store away information on the stack that will influence its future execution.

- ⦿ True

- ◯ False

Question 14

1 / 1 pts

True or false? NP-Hard problems are all verifiable in polynomial time.

○ True

⊙ False

Question 15

1 / 1 pts

True or false? Suppose a CFG has the following productions

```
S -> 01
S -> 0S1
```

the language defined by this CFG is $L(G) = \{0^n1^n \mid n > 1\}$.

○ True

⊙ False

Question 16

0 / 1 pts

True or false? The tape in a Turing machine is addressable by random access.

○ True

○ False

Question 17

1 / 1 pts

Which of the following is *incorrect* regarding Church-Turing thesis?

○ Church-Turing thesis implicates that any real-world computer or programming language can only ever do as much as a Turing machine can do, and no more.

○ Although having many evidences in its favor for Church-Turing thesis to be generally accepted as true, Church-Turing thesis is a conjecture not a proven fact.

○ Church-Turing thesis implicates that Turing machines, despite their simplicity, have all the power required to perform any computation that can in principle be carried out by a person following simple instructions.

⦿ Church-Turing thesis states that any algorithm can be performed by a nondeterministic Turing machine, not a deterministic Turing machine.

Question 18

1 / 1 pts

True or false? Adding nondeterminism, internal storage, subroutines, and multiple tapes not only gives Turing machines fundamentally new capabilities, but also make them more efficient.

○ True

◉ False

Question 19

2 / 2 pts

Which of the following statements is *incorrect*?

○ A lexical analyzer reads a raw string of characters and turns it into a sequence of tokens.

◉ Syntactic analysis can be done with regular expressions (and therefore by an NFA).

○ A syntactic analyzer reads a sequence of tokens and decide whether they represent a valid program according to the syntactic grammar of the language being parsed.

○ Lexical analysis deals with messy character-level details like variable-naming rules, comments, white spaces, etc., leaving a clean sequence of tokens for the next stage to consume.

Question 20

1 / 1 pts

True or false? In a Turing machine, a single tape serves as both storage and input: it can be pre-filled with a string of characters to be treated as input, and the machine can read those characters during execution and overwrite them if necessary.

⦿ True

○ False

Quiz Score: **20** out of 25