* Give high-level descriptaions of TMs and any PDAs in solutions * Problem 1 The class of TM-decidable languages is closed under Union: Let L, and Lz be decidable languages TMs M, and Mz decide them let TM M decide the language L: L,UL2 On input w: O Run M, on W -> if accept then ACCEPT @ Run M2 on W -> if accept onen ACCEPT OTHERWISE -> REJECT TM M ACCEPTS W IF -> M, or M, ACCEPT TM M REJECTS WIF M will Accept w -> M, and M2 both REJECT LIULZ is Decidable M decides L,UL2 Concatenation: Let Li and Lz be decidable language concatenation -> L, L2 = {xy|x & L, and y & L2} lettys M, and Mz decide L, and Lz let TM M decide L, L, On input w: 1 paration w into 2 substrings xy 1 Run Mion X ® Run Mz on y
IF both accept → HACCEPTS W (Partition must be adjusted + rerun mrough 14, if none accept after trying all - REJECT) TM - accepts when both M, and M2 accept. LILZ is decidable

Star:
for language L,
For language L, L* = \{x \in LULLULLLU\} let M. decide L
let M decide L+
" some high read descriptions of this and w study no morapid and"
"O For each possible partition of
ω , ω , ω_1 , ω_2 , ω_3 , ω_4 , ω_0
DRUM M, on w, w, (each subsection)
3 if M, accepts each w: - ACCEPT
23030000 3100 otherwise -> reject 301
TMs M. and M. decide mem
(similar to last, must partition each
Dossible way to check)
ies dogni no
7931)A 1910 79100 91 L* is decidable ()
THE STOP DONG TO SHE THE THE ME THE THE THE THE THE THE THE THE THE TH
Intersección:
let L. and Lz be decidable languages
TMs M, and M2 decide them
Joggs A Man H let M decide LIALZ TO 31.39 MMT
debined zi JUN TOTUTE ROOM H has MY
on input well assessed the
O RUN M, ON W -> if rejects, REJECT
@ If doesn't reject, run M2 on w
iF M2 accepts - ACCEPTON
Omerwise > REJECT M by M Mass
19.5 TM M decide (1,1)
LIALZ is decidable
260 200M 80
Complement: xparazous (one w compag ()
Complement: let language L be decidable TM M, decides L
TM Mi décides La Maria
TM M decides L 2000 31
on input w:
on input w: O Run M, on w > if rejects, ACCEPT otherwise -> REJECT
mal all a solving ross otherwise -> REJECT
Mos M Is decidable of Mr
79316
(if one TM of L rejects
symphos i it means wis I.)

Problem 2 TM-recognizable languages is closed Union: be recognizable languages TM. M. and Mz recognize them TM M recognizes L, UL2 On input us: DAlternate running M, and M2 on we each step IF M, or M2 accept -> ACCEPT if M, and M2 reject/noit -> REJECT (100ping) - Micops M accepts when it reaches accept scate after all the steps. → L, ULz is Recognizable M rejects when both M, and M2 reject concatenation: let Li and Lz be recognizable languages TMs M, and Mz recognize onen TM M recognites LiLz On input w: O Parcition winto 2 parts wand wa @ Ron M, on w, -> if nalt/reject, REJECT B Run M2 on W2 - if accept, ACCEPT otherwise - REJECT L.Lz is recognizable Star: a recognizable language TH M, recognizes L TM M recognites L* on input w: 1) Partition w into parts w, w2 ... wa (Run M, on W; (all parts) IF M, accepts ALL W: - ACCEPT if M, nait/rejects any wi > REJECT (must try different partitions) if WiEL onen there exists a TMM that recognites Lx

Intersection:	do
let Li and Lz be recognizable languages	
This M, and M, recognite them	
TMs M, and M2 recognite them let TM M recognite L, ML2	
· and int	1
On input w: was singo so ad bas d to	
1) Run M. on w if nat/reject, REJECT	
1 Then Ron Mz on w → if nait/reject, REJECT	-
otherwise -> ACCEPT	
* CN 3000 100	
if M, and Mz accept was M accepts w	
795001 - WE LINL2H 31 3	
7) 3L 78 4- 11801 739/37 Mb03 M 71	
a good A et angula L. N Lz is recognizable	
in anona aggina gazena arragan arragana Auguna M	
Complement: 4	
if I and I are TM-recognizable	
the L is decidable.	1
from theorem, it and I amount and	
A lang is Decidable	
Way Ball He and the Combiners	
are recognizable	
TH would Not Halt for strings not	
in the language degation	
60 608 60 5019 5 000 00 0000 00 0	

roblem3
Proposition: A language 18 decidable if and only if onese
is an enumerator which prints out a strings in
lexicographic order (increasing length)
Spaupael scientiapasse securitari ne sa I del
Proof: 2020/12 stolerbish stinder of sed bore
We have a TM, M, that decides language L
We can construct an enumerator E.
+ that generates strings in Standard order.
Less each string & L? (by using M)
- prints string if e La more
Ja L box stippolar I I Dos
Consides
Jan Haspiel and 100 2 8 mind 8 6 10 mare outsit 5
OIF Lis finite: SEMBY 100P WI no more outputs
then it is decidable → (all Anite lang Decidable)
PASSED AND STEEDER OF SENDERS
2 if Lis Infinite: Told 3
Lecopse FLM) MOMTENOUS & LINES
on input w:
1) E enomerates all strings in L
(in Standardordes)
*Until a string ordered after wis generate
ALLY 90 4030103 20000 (M) & OIF W is printed by enumerator E
book but been - ACCEPT
M arong 13 prings real and all all otherwise -> REJECT
THEROTOR OF THE PRINCE OF THE
platiania 1 'B , stindinia d 9808298
E 15 decidable because principal enumerating
Direction 1, 2010,

Problem 4	Emysk
Proposition: Every Infinite TM-recognizable language	vas
an infinite Decidable subset.	
Proof:	
let L be an infinite Recognizable language	
and has an infinite decidable subset	: 30049
There exists an enumerator E for all strings in	
All Construct on countries the	
$\frac{1}{2} \sum_{i=1}^{n} \sum_{i=1}^$	
Wis next string in order after Wi-	
Consider: David points adoing a	
O L' is infinite and L'EL	
let L' be finite Obiano)	
→ E generates all strings < Wi, one largest in L	1
→ because E generates finite # strings < wi	
Commence of south as Lis finite -> CONTRADICTION!	
Also: Monly ACCEPTS IF In Sond Order	
->* L' 18 NOTANITE -> L'is Infinite	
Because E. Printed all Strings & L',	
→+ L'CL >ogni no	
OF COMMERCES ALL SOUNCES IN	
2) L'is decidable	
*Undl & Eding ordered after us a gener	
can construct E'	itor
79700A on no input:	
1 prints out strings accepted by M	
-> Meaning all in Standard Order	
Because Lis infinite, E'is infinitely	5
E'is decidable because prints stud en umerating	
→ Therefore, the language	
L', of E' is decidable	
11:2 an infinite decidable RITOSPK OP	
L' is an infinite decidable subset of	
L, an infitie Recognitable language	