COMPS265F

Assignment 2

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Question 1 (30 marks)

Please check 91.py.

29 - should only print 7 if not fullfillay constrai

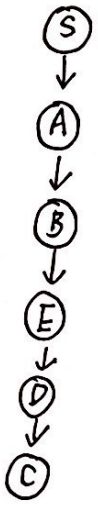
Question 2 (15 marks)

(a) [8]

The required information of each vertex is shown below:

discovered order	1	2	3	4	5	6
vertex V	S	A	B	E	D	C
d[V]	1	2	3	4	5	6
f[V]	12	11	10	9	8	7
π[V]	–	S	A	B	E	D

The depth-first tree:



✓

(b) Classification of edges: [4]

edge	(S,A)	(A,B)	(B,E)	(E,D)	(B,D)	(D,C)	(A,C)	(S,C).
type	tree	tree	tree	tree	forward	tree	forward	forward

✓

(C) [3]

The ordering of the vetices obtained by the topological sort is:

(S, A, B, E, D, C).

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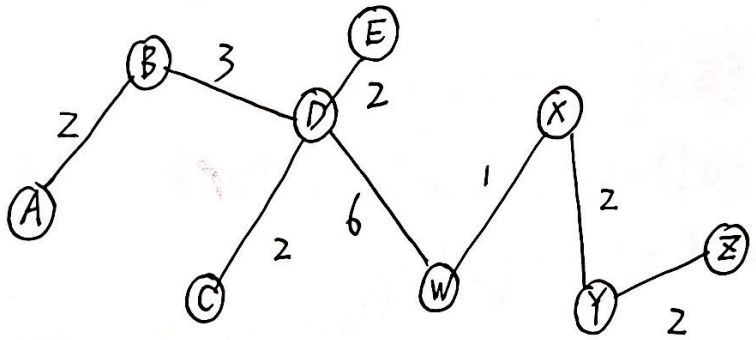
Question 3 (15 marks)

order	1	2	3	4	5	6	7	8	9	10	11	12	13
edge	(X,W)	(X,Y)	(Y,W)	(A,B)	(C,D)	(Y,Z)	(E,D)	(B,D)	(X,Z)	(B,C)	(A,C)	(D,W)	(E,X)
weight	1	2	2	2	2	2	2	3	3	3	3	6	6
include or not	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No

The resultant MST is as follows:



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total weight : $2+3+1+2+2+2+2+6=20$

Question 4 (40 marks)

(a) [10]

For the NFA, the transition table f_ε with the lambda closures is:

f_ε	S	a	b	C	ε	λ(s)
start	0	∅	∅	∅	{1}	{0, 1, 3}
	1	{2}	∅	∅	{3}	{1, 3}
	2	∅	{1}	∅	∅	{2}
	3	{4}	∅	{4}	∅	{3}
final	4	∅	∅	∅	∅	{4}

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Question 4 (cont'd)

(b) [20]

Constructing the transition table f_D of DFA, as follows:

start state $= \lambda(0) = \{0, 1, 3\}$

$f_D(\{0,1,3\}, a) = \lambda(f_\varepsilon(0,a) \cup f_\varepsilon(1,a) \cup f_\varepsilon(3,a))$

$= \lambda(\phi \cup \{2\} \cup \{4\}) = \lambda(\{2,4\})$

$= \{2,4\}.$

$f_D(\{0,1,3\}, b) = \lambda(f_\varepsilon(0,b) \cup f_\varepsilon(1,b) \cup f_\varepsilon(3,b))$.

$= \lambda(\phi \cup \phi \cup \phi) = \lambda(\phi) = \phi$

$f_D(\{0,1,3\}, c) = \lambda(f_\varepsilon(0,c) \cup f_\varepsilon(1,c) \cup f_\varepsilon(3,c))$

$= \lambda(\phi \cup \phi \cup \{4\}) = \lambda(\{4\}) = \{4\}.$

Therefore, we have the following table:

	f_D	a	b	c
start	$\{0,1,3\}$	$\{2,4\}$	ϕ	$\{4\}$

✓

There are two new final state:

$\{2,4\}$ $\{4\}$.

$f(\{2,4\}, a) = \phi$ $f(\{2,4\}, b) = \{1\}$ $f(\{2,4\}, c) = \phi$.

$f(\{4\}, a) = \phi$ $f(\{4\}, b) = \phi$ $f(\{4\}, c) = \phi$.

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	f_D	a	b	c
start	$\{0,1,3\}$	$\{2,4\}$	ϕ	$\{4\}$.
final	$\{2,4\}$	ϕ	$\{1\}$	ϕ
final	$\{4\}$	ϕ	ϕ	ϕ
~~$\{1\}$~~		~~$\{2\}$~~	~~ϕ~~	~~ϕ~~
~~$\{2\}$~~		~~ϕ~~	~~$\{1\}$~~	~~ϕ~~
ϕ		ϕ	ϕ	ϕ

$f(\{1\}, a) = \{2\}$.
$f(\{1\}, b) = \phi$
$f(\{1\}, c) = \phi$
$f(\{2\}, a) = \phi$
$f(\{2\}, b) = \{1\}$.
$f(\{2\}, c) = \phi$.

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Question 4 (cont'd)

(b) [cont'd]

We rename the six states to 0, 1, ..., 5:

fD	S	a	b	C
start	0	1	2	3
final	1	2	4	2
final	3	2	2	2.
	4	5	2	2.
	5	2	4	2.
	2	2	2	2

(c) [7]

States 2 and 3 have the same transition for all inputs, but state 2 is non-final while state 4 is final.

States 1 and 5 have the same transition for all inputs, but state 5 is non-final while state 1 is final

Therefore we cannot merge them

(d) [3]

As a result, we obtain the following DFA:

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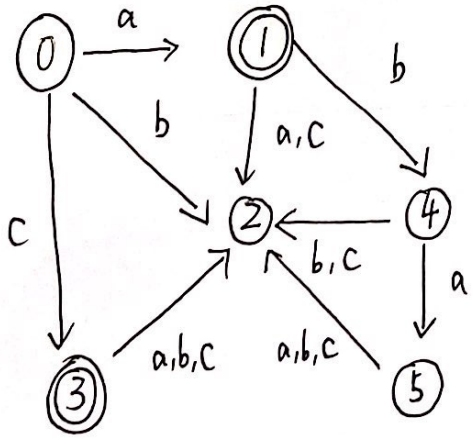

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