1. (20%) For the following weighted, directed graph

- run FASTER-ALL-PARIS-SHORTEST-PATHS algorithm.
- run FLOYD-WARSHELL algorithm.
(question 1, continued)
2. (20%) 

- Modify the EXTEND-SHORTEST-PATHS and SLOW-ALL-PAIRS-SHORTEST-PATHS to calculate the transitive closure of a graph.
- Find the transitive closure of the following graph using the modified algorithm. Show all the steps.

![Graph Diagram]

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(question 2, continued)
3. (25%) Apply the Ford-Fulkerson method to the following network. Show residual networks, augmenting paths, final cut, and total flow. The following two searching algorithms are used. The priority orders of nodes are $r$, $s$, $t$, $u$, and $v$.

- Depth-first search
- Breadth-first search
(question 3, continued)
4. (15%) Suppose $\Sigma = \{a, b\}$, build an automaton $A$ that accepts those strings that end in $ab$ and have even number of occurrences of $ab$. For example, $A$ accepts $aabababaab$, $abab$, and $aaabbab$, but rejects $aababab$, $ababa$, and $ababb$. 
5. (20%)

- Compute the prefix function $\pi$ for the pattern $ababa$ when the alphabet is $\Sigma = \{a, b\}$.

- Use Knuth-Morris-Pratt algorithm to detect pattern $P = ababa$ in string $ababbababababa$. Show all the necessary shifts.
(question 5, continued)