Example Questions for Test #2 (Open Books/Notes)

Part I : Multiple – Choice Problems (60%). 6 points each. Select one correct answer in each problem. There will be 10 questions. One question will be on case study #2, one question will be on case study #3, 2 questions will be on 2 papers, one each, and 6 questions will be on SPN modeling and analysis. Below are some example questions on papers to give you some idea of the format of the questions on papers. Note: these papers are not the papers that you will be tested on in this exam.

1. For the paper entitled "Agent-based forwarding strategies for reducing location management cost in mobile networks," under the TLA algorithm (Figure 2 on page 9) what is the cost (in terms of time) per update operation given that the system is in state (0,1,1)?
   (a) δ
   (b) $1/\delta$
   (c) $(1-\theta) \times (1/\delta)$
   (d)
   $$\left(\sum_{i=0}^{1}(P_{(0,0,i)} + P_{(1,0,i)}) \times (1-\theta) \times (1/\delta)\right) \; + \; \left(\sum_{i=0}^{1}(P_{(0,1,i)} + P_{(1,1,i)}) \times (1/\delta)\right)$$
   (e)
   $$\left[\left(\sum_{i=0}^{1}(P_{(0,0,i)} + P_{(1,0,i)}) \times (1-\theta) \times (1/\delta)\right) \; + \; \left(\sum_{i=0}^{1}(P_{(0,1,i)} + P_{(1,1,i)}) \times (1/\delta)\right)\right] \times \sigma/\lambda$$

2. For the paper entitled "Performance analysis of cellular mobile communication networks supporting multimedia services," if we want to calculate the average *throughput* of the cell base station, i.e., # of requests departed out of the cell per unit time, via $\sum_{s=0}^{s_{max}} T(s)p(s)$ where $T(s)$ is the throughput of the cell given that the cell is in state s and $p(s)$ is the probability that the cell is in state s, then what would be the correct expression for $T(s)$? A state s is presented by (v, d, m, r) as defined in Section 2.2 on page 169 of the paper.
   (a) $v + d + m + r$
   (b) $v + dC_d + m(C_d + 1) + r$
   (c) $v\mu_{hv} + d\mu_{hd} + m\mu_{hm} + r\mu_{hm}$
   (d) $v\mu_v + d\mu_d + m\mu_m + r\mu_m$
   (e) $v\mu_{hv} + d\mu_{hd} + m\mu_{hm} + r\mu_{hm} \; + \; v\mu_v + d\mu_d + m\mu_m + r\mu_m$

3. For the paper entitled "An analytic model of hierarchical mass storage systems with network-attached storage devices," the authors said that the analytical solutions obtained are only approximate solutions because:
   (a) they did not use the MVA solution technique to solve the queueing network model
   (b) they still used the MVA solution technique to solve the queueing network but they modified the response time equation at the file server center
   (c) they still used the MVA solution technique to solve the queueing network but they modified the response time equation at the network attached disk server center
   (d) they still used the MVA solution technique to solve the queueing network but they modified the response time equation at the network-attached tape server center
   (e) their model does not reflect an actual storage system with network-attached devices

4. For the paper entitled "A cost-based admission control algorithm for digital library multimedia systems storing heterogeneous objects," the partition serving only image requests with a queue size of $2n_I$ is modeled by a $M/M/1^{n_I}/2n_I$ queue with its Markov model shown in Figure 2. Let $P_I(j)$ be the steady-state probability that there are j image requests in the system. What is the reward rate due to departure events of image requests in the system?
   (a) $\left(\sum_{j=1}^{n_I} j\mu_I \times v_I \times P_I(j)\right)$
   (b) $\left(\sum_{j=n_I}^{2n_I} n_I\mu_I \times v_I \times P_I(j)\right)$
   (c) $\left(\sum_{j=n_I}^{2n_I} j\mu_I \times v_I \times P_I(j)\right)$
   (d) $\left(\sum_{j=1}^{n_I} j\mu_I \times v_I \times P_I(j)\right) + \left(\sum_{j=n_I+1}^{2n_I} n_I\mu_I \times v_I \times P_I(j)\right)$
   (e) $\left(\sum_{j=1}^{n_I-1} j\mu_I \times v_I \times P_I(j)\right) + \left(\sum_{j=n_I}^{2n_I} n_I\mu_I \times v_I \times P_I(j)\right) - \lambda_I q_I \times P_I(2n_I)$

5. For the paper entitled "On Integrated Location and Service Management for Minimizing Network Cost in Personal Communication Systems," one major difference between the SPN model in Figure 6 (for modeling dynamic anchor) with the SPN model in Figure 7 (for modeling static anchor) is that place `flag` exists in Figure 6 but not in Figure 7. Which one of the following events will not access (read/write) `flag`?
   (a) a call event
   (b) a MU inter-anchor movement event
   (c) a MU intra-anchor movement event
   (d) a MU service request event
   (e) a server movement event

Part II : Modeling and Analysis Problems (40% + 20%bonus).

Three questions (20 points each) will be given in Part II. Question 1 and Question 2 are related to HW#3. You may be asked to write partial SPNP code for performance/reliability/availability analysis. Question 3 is a bonus question on drawing the underlying Markov model of a given SPN model.