※ 考生請注意：本試題 ☑可 □不可 使用計算機

1. Let us consider two basins and assume the precipitation pattern to be mainly orographic. Basin A is near the coastline and the ground elevation is relatively flat. Basin B is at the slope of the mountain range where the ground elevation changes significantly. Answer the following two questions: (Please state the critical points and do not spend much time on detailed descriptions.)

   (a) [5 pts] Which of the two methods: Thiesson Polygon Method, and Isohyetal Method would you use to obtain the areal precipitation for Basin A and why? Which method would be used for Basin B and why?

   (b) [5 pts] Which basin would be better suited for the application of the Unit Hydrograph method and why?

2. Consider a region in which infiltration capacity (units of in/hr) is well-approximated by the Horton equation:

   $$f(t) = f_c + (f_0 - f_c)e^{-kt},$$

   and cumulative infiltration (in inches) under potential infiltration is given by:

   $$F(t) = \int_0^t f(t)dt$$

   At the onset of a storm, it rains for three hours at the rate of 0.45 inches per hour. Abruptly, the storm picks up and during the fourth hour rain falls at the rate of 1 inch per hour. In answering the following questions, you may find some of the following results useful as a supplement to your own calculations:

   F (1.0 hr) = 1.35 inches

   F (2.0 hr) = 2.18 inches

   F (3.0 hr) = 2.75 inches

   F (4.0 hr) = 3.19 inches

   (a) [10 pts] During the fourth hour, is infiltration capacity-controlled or precipitation-controlled? How much infiltration occurs during this hour?

   (b) [10 pts] Do you expect runoff to occur at any time during the four hours? If so, when and how much?

(背面仍有題目,請繼續作答)

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3. A basin has flood characteristics (annual maximum runoff) which are well-described by the corrected Pearson Type III model (see table below of frequency factors K) with average = 4000 cfs, standard deviation S = 3500 cfs, and skew coefficient Sc =2.3.

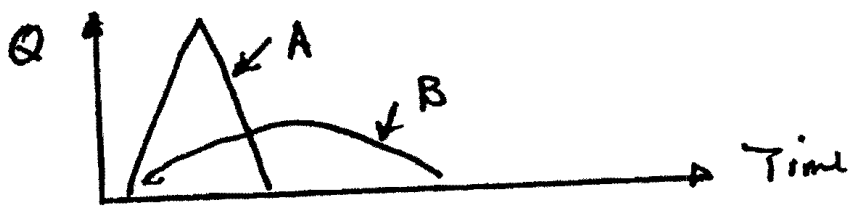
	Recurrence Interval in Years			
Skew Coefficient Sc	2	5	10	25
	Percent Chance of Exceeding			
	50	20	10	4
2.7	-0.376	0.479	1.224	2.272
2.6	-0.368	0.499	1.238	2.267
2.5	-0.360	0.518	1.250	2.262
2.4	-0.351	0.537	1.262	2.256
2.3	-0.341	0.555	1.274	2.248
2.2	-0.330	0.574	1.284	2.240
2.1	-0.319	0.592	1.294	2.230

(a) [5 pts] What is the magnitude of the 5-year flood?

(b) [5 pts] What is the probability that at least one such flood will happen in a five year interval?

(c) [5 pts] What is the magnitude of the 1-year flood?

4. The two following Unit Hydrograph Curves A and B were derived for the same basin. One was for natural condition and the other is for the current condition after the urban development.



(a) [5 pts] Which curve is more likely to be derived from the current condition after urban development?

(b) [5 pts] Which curve will have greater area under the curve?

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5. Given the following three-hour duration Unit Hydrograph (based on one inch of runoff) from a basin,

Time (hours)	0	2	4	6	8	10	12
cfs	0	0.7	1	1.5	0	0	0

(a) [10 pts] Determine a two-hour duration Unit Hydrograph?

(b) [10 pts] Determine the runoff from the outlet of the basin by the following rainfall pattern [0-3 hours => 1.5 in/hour; and 4-6 hours => 2 in/hour]

(c) [10 pts] What is the approximate area of this basin?

6. Flow routing is a procedure to determine the time and magnitude of flow at a point, which is typically characterized into the lumped system routing and the distributed one. In the latter, the *Saint-Venant* equation were developed to describe one-dimensional unsteady open channel flow (neglecting lateral inflow, wind shear, and eddy losses), which takes the form

$$\frac{1}{A}\frac{\partial Q}{\partial t}+\frac{1}{A}\frac{\partial}{\partial x}\left(\frac{Q^2}{A}\right)+g\frac{\partial y}{\partial x}-gS_0+gS_f=0,$$

where Q, A, and y denote flow discharge, the area, and water level, respectively.

(a) [6 pts] Please define the physical meaning of each of five terms in the above equation.

(b) [9 pts] Based on this equation, please identify the kinematic, diffusion, and dynamic models, respectively. (i.e. how many terms should be included in these models, respectively?)